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International Specialists in the Environment

M E M O R A N D U M

TO: Ed Sierra, Region VI RPO

THRU: K. H. Malone, Jr., FITOM

FROM: Brenda Nixon Cook, FIT Chemist

TDD: F06-8908-34
PAN: FTX1006PAA

DATE: June 6, 1990

SUBJECT: Preliminary Assessment
Houston Light and Power Greens Bayou Station
Houston, Harris County, TX
(TXD000837435)

Attached is the Preliminary Assessment report of the Houston Light and Power Greens Bayou Station.

In the References of this report, the site name is printed on the company's letterhead as Houston Lighting and Power. The sign in Photograph 2 also reads Houston Lighting and Power.

TDD F06-8908-34, however, lists the site as Houston Light and Power. For this reason, the site is referred to as Houston Light and Power throughout this report.

PRELIMINARY REPORT
This does not constitute
final opinion of EPA

Reviewed by 6H-ES
Date _____

PRELIMINARY ASSESSMENT

of

HOUSTON LIGHT AND POWER GREENS BAYOU STATION

(TXD000837435)

Prepared By

Brenda Nixon Cook, FIT Chemist

Ecology and Environment, Inc.
Region VI

June 6, 1990

PRELIMINARY ASSESSMENT

of

HOUSTON LIGHT AND POWER GREENS BAYOU STATION

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1. SITE INFORMATION

The Ecology and Environment, Inc. (E & E) Field Investigation Team (FIT) was tasked by the U.S. Environmental Protection Agency (EPA) under Technical Directive Document (TDD) F06-8908-34 to conduct the Preliminary Assessment (PA) of the Houston Light and Power Greens Bayou Station (TXD000837435) in Houston, Harris County, Texas.

1.1 SITE LOCATION

The Houston Light and Power (HL & P) Greens Bayou Station is located at 12070 Beaumont Highway, Houston, Harris County, Texas (Figure 1). Geographic Coordinates are 29°48'49" north latitude and 95°13'13" west longitude (Ref. 2).

1.2 SITE BACKGROUND

HL & P is privately owned and operated by Houston Industries Incorporated. The total operating revenue for HL & P in 1988 was $3,063,573,000 and sales totaled 57,113,432,000 kilowatt hours (Ref. 19).

2. BACKGROUND AND OPERATING HISTORY

The site's history, known and potential problems and regulatory involvement are addressed below.

2.1 SITE HISTORY

HL & P Greens Bayou Station generates, transmits, distributes and sells electric energy to the residents of Houston (Ref. 2). The facility produces electric energy by the utilization of gas turbines to produce steam. The first turbine came on-line in 1949 and the last in 1976 (Ref. 19). The facility utilizes City of Houston surface water for its cooling towers and other plant uses (Ref. 3, p. 1). The major on-site waste management facilities include a waste water treatment system, sand drying beds, a 0.19 acre metal cleaning inorganic acid collection impoundment, a 0.57 acre demineralizer regenerent collection impoundment, a 0.27 acre metal cleaning organic acid collection impoundment, two oil ash wash impoundments (0.49 and 0.74 acres) and a hazardous waste container storage area (Figure 2) (Ref. 2).

2.2 KNOWN AND POTENTIAL PROBLEMS

Contaminants of concern at the facility are metals, corrosive waste water and drummed solvents. Heavy metals such as arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver are common constituents of power plant waste water. Analytical results of ground water samples collected at the facility detected an increase of sulfates with time, indicative of possible caustic waste water migration into the

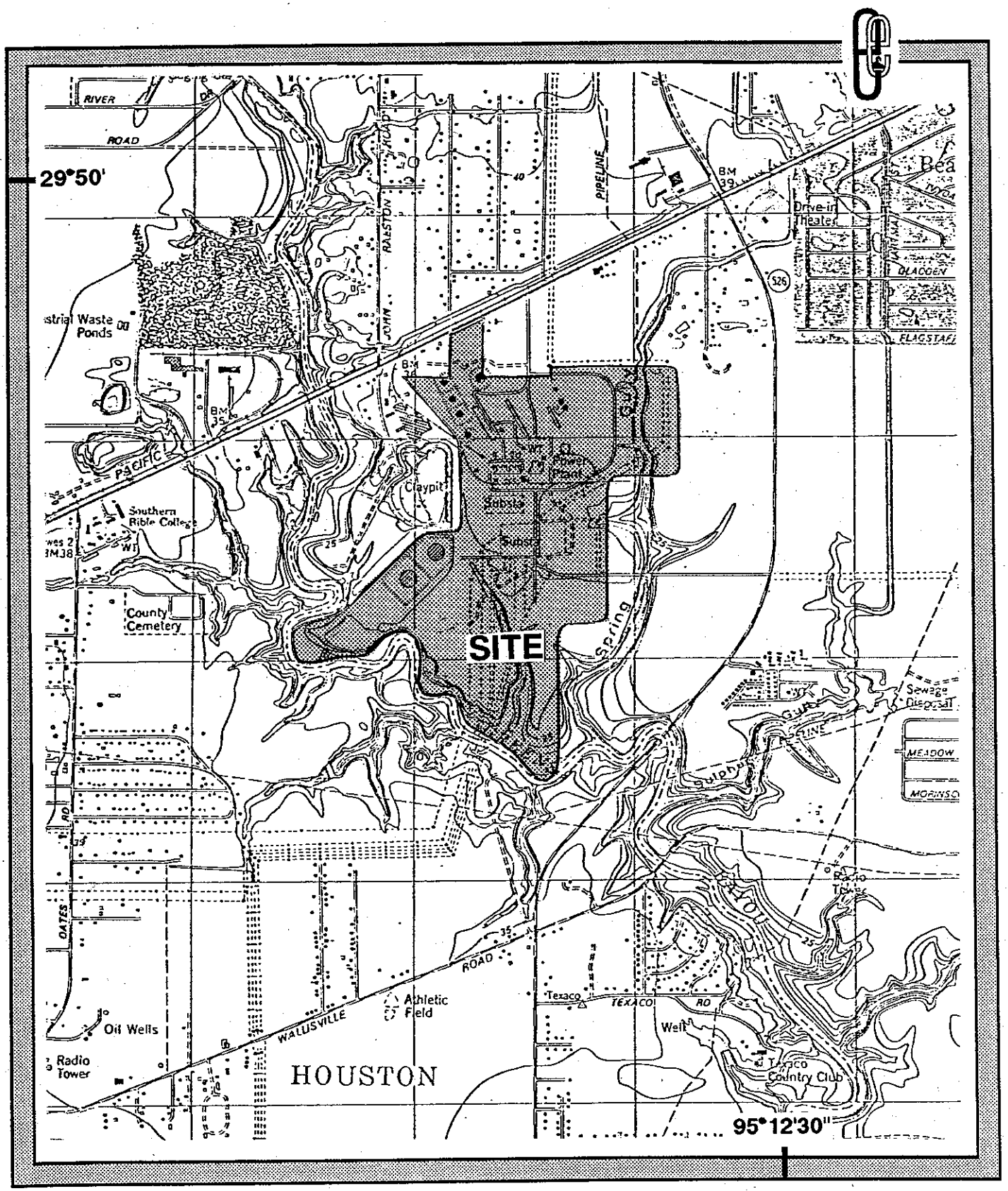

FIGURE 1

SITE LOCATION MAP

HOUSTON LIGHT AND POWER GREENS BAYOU STATION
HOUSTON, TEXAS
TXD000837435

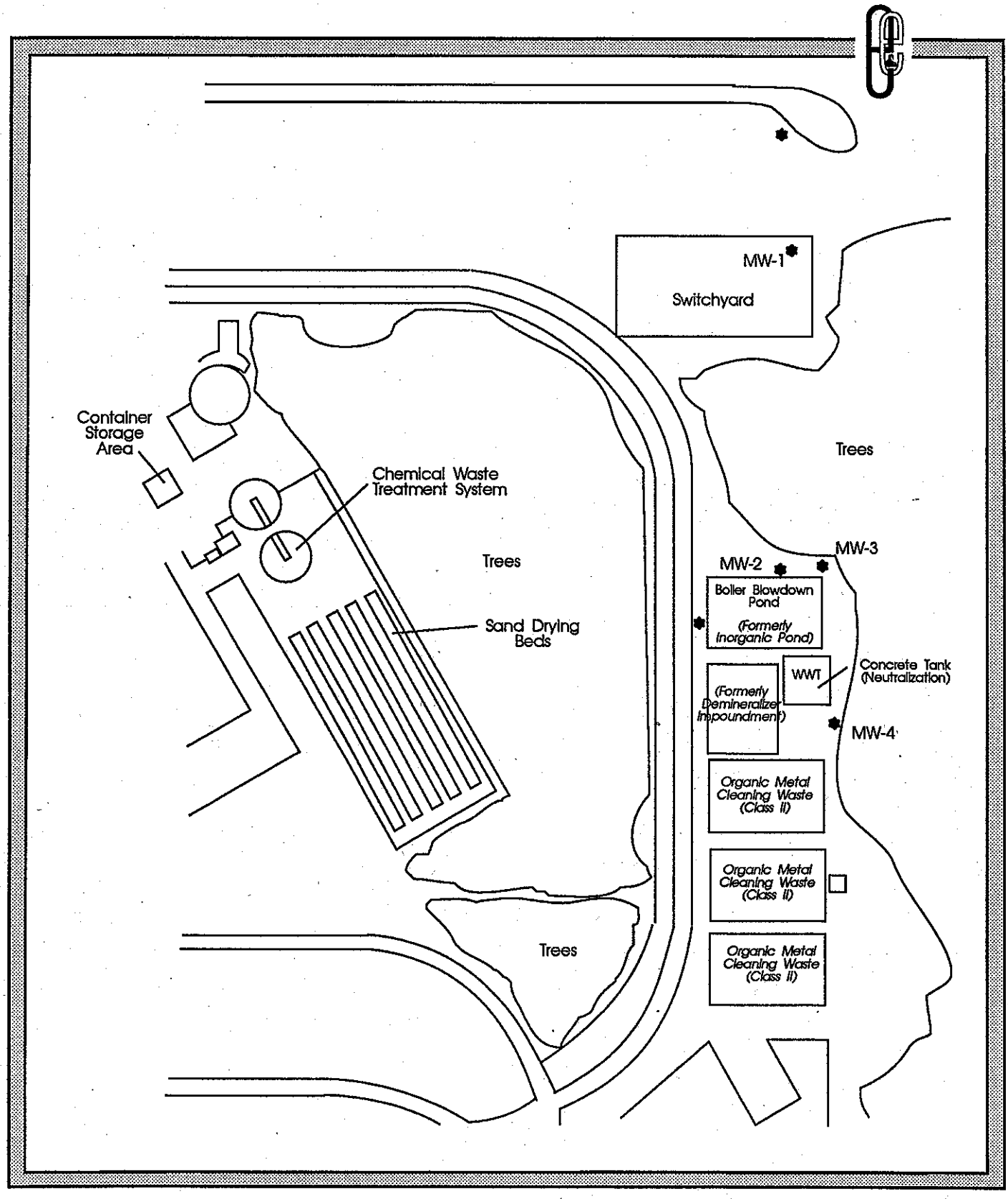

FIGURE 2

SITE SKETCH

HOUSTON LIGHT AND POWER GREENS BAYOU STATION

HOUSTON, TEXAS

TXD000837435

alluvial aquifer (Ref. 12; Ref. 13, pp. 39, 42, 43; Ref. 23, p. XVII). Sludge samples were collected from the demineralizer impoundment as a part of closure activities. Analytical results indicated lead, chromium and barium above detection limits (Ref. 10, p. 3).

The FIT conducted an off-site reconnaissance inspection on October 13, 1989. The facility was secured by a chain link fence topped with barbed wire. The main gate was closed and guarded. The impoundments could be viewed from the road. Each impoundment was surrounded by a chain link fence and two of the impoundments had Caution Acid signs posted (Photographs 1 through 13).

Information used to prepare this PA was obtained from EPA files and state and local agencies. No emergency or remedial action is known to have taken place at the facility.

2.3 REGULATORY INVOLVEMENT

The Texas Water Commission (TWC) conducted closure inspections in February 1985 and August 1986, and a comprehensive ground water monitoring inspection in October 1987 (Ref. 6; Ref. 7; Ref. 23). The demineralizer impoundment, inorganic impoundment and hazardous waste container storage area have been certified closed by a licensed engineer. The container storage area has been reopened as a less than 90 day storage area (Ref. 5). The facility has filed for exemption as a hazardous waste generator. In July 1987, sulfates were detected in the monitoring wells during routine ground water sampling by TWC. The facility holds TWC registration number 31634, EPA CERCLIS number TXD000837435 and NPDES permit number TX006386 (Ref. 2; Ref. 5).

3. WASTE CONTAINMENT AND HAZARDOUS SUBSTANCE IDENTIFICATION

Solid Waste Management Units (SWMUs) and the on-site hazardous substances are detailed below.

3.1 DOCUMENTATION

The following information was gathered from EPA permit applications, state files, closure plans, ground water assessment plans and correspondence between the facility and federal and state agencies (Ref. 5; Ref. 7; Ref. 9).

3.2 WASTE GENERATION

The following hazardous wastes streams were listed on the TWC 1986 Notice of Registration:

- Demineralizer Acid and Base Regenerant Waste Water. Demineralizer regenerant waste is collected in the demineralizer impoundment and pumped to the chemical waste water treatment system for pH adjustment. Treated waste water is discharged in accordance with the NPDES permit.

- o Inorganic Metal Cleaning Waste. Waste is collected in the inorganic impoundment and then pumped to the chemical waste treatment system for pH adjustment and removal of suspended solids and metals. Treated waste water is discharged through the NPDES outfall.

- o Spent Solvents. Spent solvents are collected in drums, mixed with waste oil for recycling, or incinerated in the boiler.

- o Paint Thinner. Paint thinner is collected in drums and temporarily stored prior to off-site disposal.

- o Hydrazine. Hydrazine is collected in drum storage for less than 90 days prior to off-site disposal.

- o Sandblast Grit. Sandblast grit is held in the container storage area for less than 90 days prior to off-site disposal.

- o Mercury Contaminated Waste. Mercury contaminated waste is collected in drums and stored for less than 90 days prior to off-site disposal.

3.3 CONTAINMENT

The following SWMUs were identified.

SWMU 1 Demineralizer Regenerent Collection Impoundment. The demineralizer impoundment, or demineralizer collection pond, is located northeast of the main facility along the entrance road to the main gate. It is located south of the inorganic impoundment and north of the organic impoundments (Figure 2). Its dimensions are approximately 142 x 180 x 8 feet. The impoundment sides have slopes of 1 to 3 percent. The impoundment has a compacted clay liner which is three feet thick on the bottom and two feet thick on the sides (Ref. 8).

The original demineralizer impoundment was placed in service in 1973 and received all plant waste water until 1976. It was divided in 1976 and 1977 into two separate impoundments: the inorganic metal cleaning waste impoundment and the demineralizer regenerant waste impoundment.

The impoundment collected waste water from demineralizer regeneration, drains from sample house 5, plant laboratory, polishing demineralization, chemical drains and treated sewage from the waste water treatment plant (Ref. 8).

This unit was closed in September 1984. As a condition of closure, sludge samples were collected from the impoundments and analyzed for EP Toxicity Metals. Analytical results indicated lead, chromium and barium above detection limits (Ref. 10). After closure, eight inches of structural sand were spread over the closed impoundment and a lined concrete tank was constructed to hold inorganic acid metal cleaning wastes (Ref. 6, p. 25; Ref. 9, p. 8). This unit is considered an elementary neutralization tank and is exempt from permitting.

SWMU 2 Inorganic Metal Cleaning Waste Surface Impoundment. The inorganic metal cleaning waste surface impoundment is located northeast of the main facility, along the entrance to the main gate. It is located north of the demineralizer impoundment (Figure 2). The dimensions of the impoundment are 120 x 180 x 10 feet, with side slopes of 1 to 3 percent. It has a compacted clay liner which is three feet thick on the bottom and two feet thick on the sides (Ref. 8). The impoundment received inorganic acid cleaning wastes and boiler blowdown until its closure in 1984. After closure, the impoundment was reopened as a Class II non-hazardous surface impoundment receiving boiler blowdown and the non-hazardous portion of inorganic acid metal cleaning wastes (Ref. 8, p. 12).

SWMU 3 Container Storage Area. The Greens Bayou Station operated a container storage area (drum) for the collection of waste solvents used in degreasing and painting operations prior to off-site disposal. The container storage area is located in the building across from the waste water treatment facility (Figure 2). Wastes stored in this area include sandblast grit, spent solvents, hydrazine, mercury contaminated wastes, paint thinner and paint wastes (Ref. 7; Ref. 8).

The containment features include an enclosed metal building with a concrete slab. A No Smoking sign and an Asbestos Dust Hazard sign are posted. Access is prohibited by a lock. Containers were reportedly in good condition and checked weekly for deterioration (Ref. 7).

A closure plan for the container storage area was submitted to the Texas Department of Water Resources (TDWR) in May 1985. The area was certified closed in November 1985, constituting a full facility closure of all hazardous wastes units. The container storage area currently operates under the 90 day storage exemption (Ref. 5; Ref. 11).

SWMU 4, 5, 6 Organic Metal Cleaning Waste Surface Impoundments. Organic metal cleaning wastes from boiler cleaning operations are stored in three clay lined impoundments located south of SWMUs 1 and 2. The waste is generated from ammoniated citric acid or hydroxyacetic-formic acid boiler and equipment cleanings. SWMU 4 is reportedly 0.27 acres. SWMUs 5 and 6 are reportedly 0.49 and 0.74 acres. SWMUs 5 and 6 were originally designed to contain waste from oil washes, but they never received this waste. They are currently used to store organic metal cleaning wastes from four other Houston Light and Power Plants (Ref. 4; Ref. 5). The waste is injected into an energy producing boiler for incineration. Wastes entering these impoundments are classified as Class II industrial solid waste. The impoundments, therefore, have not received hazardous wastes (Ref. 2; Ref. 6; Ref. 9, p. 16).

SWMU 7 Sand Drying Beds. Two below-grade earthen basins are located south of the chemical waste treatment system. They are used as drying beds for the collection and processing of sludge dewatering from the chemical waste treatment system. Dried sludge is disposed off-site (Ref. 9, p. 16).

SWMU 8 Chemical Waste Treatment System. The chemical waste treatment system is located west of the impoundment areas and north of the sand drying beds. Information pertaining to the components of this system was not located in EPA, state or local files. The waste system is constructed of concrete, and is used to treat demineralizer regenerant, inorganic metal cleaning waste and boiler blowdown, prior to NPDES discharge. The sludge, which accumulates in the settling chamber of the treatment system, is pumped to sand drying beds for dewatering and periodic off-site disposal (Ref. 9, p. 16).

SWMU 9 Waste Oil And Sludge Collection Facility. This unit is shown on a map accompanying Hazardous Waste Permit Application (Part A) for the Houston Light and Power Greens Bayou Station. No other information regarding this unit was available from EPA, state or local files.

4. PATHWAY CHARACTERISTICS

Ground water, surface water, soil exposure and air characteristics are detailed below.

4.1 GROUND WATER

The Greens Bayou Station is located on the Pleistocene Beaumont Formation, which is characterized by interdistributary areas of fluvial dominated delta plains. The sediments of the subject area are clay dominated and predominantly represent overbank flooding deposition. These clays have low permeability, high waterholding capacity, high to very high swell potential, poor drainage, low shear strength and high plasticity.(Ref. 3, p. 5; Ref. 14).

The most important water bearing units in the Houston area are the Chicot and Evangeline Aquifers. The Chicot is comprised of the Beaumont, Montgomery, Bentley formations and the Willis Sand. The Chicot Aquifer system ranges from 600 to 900 feet thick in the area. The underlying Evangeline Aquifer is approximately 1,000 feet thick and is underlain by the Burkeville confining layer. The basis for separating the Chicot and Evangeline Aquifers is primarily a difference in hydraulic conductivity (Ref. 3, pp. 13-15).

Ground water is used extensively in northeast Houston for domestic and industrial purposes. There are three known industrial wells on-site. They are screened in the Evangeline Aquifer at depths ranging from 735 to 1,500 feet. There are at least 33 public water supply wells and 191 domestic wells within a four mile radius of the site. The public supply wells produce either from the Chicot or Evangeline Aquifers at depths ranging from 229 to 1500 feet. The domestic wells are generally screened in the upper portion of the Chicot Aquifer at depths ranging from 60 to 150 feet. On-site monitoring wells are located in the alluvial aquifer at depths ranging from 15 to 20 feet.

The net precipitation in the Houston area is 12.3 inches annually (Ref. 1; Ref. 3, p. 19, Appendix A; Ref. 14).

4.2 SURFACE WATER

The facility is bounded on the east by Spring Gully and on the west and south by Greens Bayou. The topography is relatively flat, except where incised by Spring Gully and Greens Bayou. On-site drainage flows into both Greens Bayou and Spring Gully (Ref. 3, p. 4; Ref. 25). The facility discharges its cooling and treated waste water into Spring Gully under NPDES permit TX0006386 (Ref. 8, p. 1). Spring Gully empties into Greens Bayou at the southern tip of the facility. The downstream, in-water segment continues along Greens Bayou for eight miles, until Greens Bayou empties into Buffalo Bayou (a.k.a. Houston Ship Channel) and continues along Buffalo Bayou for five miles until Buffalo Bayou empties into the confluence of the San Jacinto River, Houston Ship Channel and Burnett Bay (Ref. 25).

Greens Bayou has no known recreational uses and is used primarily for storm runoff and industrial purposes. Buffalo Bayou is used for non-contact recreation and navigation. Burnett Bay and the San Jacinto River are classified by the TWC Surface Water Quality Board as suitable for contact recreation and able to support high quality aquatic life. There are no known surface water intakes along the 15 mile in-stream segment (Ref. 25; Ref. 26).

The upgradient drainage area is estimated at 405 acres (Ref. 2). The average stream flow of Greens Bayou at the Highway 59 Bridge, 12 miles upstream of the facility, is 65.5 cubic feet per second (cfs). The average stream flow of Buffalo Bayou 16 miles upstream of the point of entry into Greens Bayou, is 272 cfs (Ref. 15). The Greens Bayou Station is not located within the 100 year floodplain (Ref. 13). The two year, 24 hour rainfall is five inches (Ref. 4).

4.3 SOIL EXPOSURE

The Greens Bayou Station is an active facility employing approximately 100 to 250 people. The site is surrounded by a chain link fence topped with barbed wire. No Trespassing signs are posted on the perimeter fence and Caution Acid signs are posted on the impoundment fences. The front gate has a manned guard house. The surface impoundments that contained the hazardous demineralizer regenerant and inorganic cleaning wastes have been closed and replaced by fiberglass lined concrete tanks (Ref. 8). The hazardous waste container storage area was closed, but has been reopened as a less than 90 day storage facility. Waste currently stored in drums in this area include paint thinner, mercury contaminated wastes, spent solvents and sandblast grit. The storage area is located in a building with concrete floors. Warning signs are posted. There is no resident population other than on-site workers (Ref. 4; Ref. 5; Ref. 7; Ref. 8).

4.4 AIR

On-site wastes have been classified as hazardous based on corrositivity. The wastes in the impoundments and drying beds are in sludge form and are not readily available to the air pathway.

5. TARGETS

Ground water, surface water, soil exposure and air targets are described below.

5.1 GROUND WATER

Ground water from the Chicot and Evangeline Aquifers is used extensively in northeast Houston for drinking water, industrial and possibly irrigation purposes. There are 16 municipal water districts with wells located within a four mile radius of the facility (Ref. 3). There are at least 33 public supply wells and 191 domestic wells within the target distance. The nearest well is located 1,320 feet northeast of the facility boundary at the Ralston Acres Subdivision (Ref. 3, Appendix A). Approximately 64,500 people located within a four mile radius of the facility utilize ground water (Ref. 16).

5.2 SURFACE WATER

The 15 mile in-stream segment encompasses portions of Spring Gully, Greens Bayou, Buffalo Bayou, Burnett Bay and the San Jacinto River. San Jacinto State Park is located approximately 14 miles downstream of the facility. There are some fresh water wetlands contiguous to the confluence of Buffalo Bayou, San Jacinto River and Burnett Bay. There are no commercial fisheries or drinking water intakes located along the 15 mile in-stream segment. Buffalo Bayou is used primarily for navigation and non-contact recreation. San Jacinto River and Burnett Bay are designated as high aquatic life habitats by the Texas Water Quality Board (Ref. 25; Ref. 26).

5.3 SOIL EXPOSURE

The Greens Bayou Station is an active facility employing approximately 100 to 250 people. The population within one mile is estimated at 4,500 (Ref. 16). Surface impoundments have been closed and hazardous wastes are no longer stored on-site , except in the container storage area (Ref. 8). There are no known on-site residents or terrestrial sensitive environments.

5.4 AIR

There are an estimated 64,500 residents within a four mile radius of the facility (Ref. 16). Land usage is residential, commercial and industrial (Ref. 23). The nearest residence is within 500 feet of the northern property fence (Ref. 25). There are no known sensitive environments located within a four mile radius of the facility (Ref. 17).

6. CONCLUSIONS

Houston Light and Power Greens Bayou Station is an active, electric power generating station. A documented release of non-hazardous sulfates to the alluvial aquifer has taken place. Two hazardous waste surface impoundments, a demineralizer impoundment and an inorganic metal

waste impoundment, were operated on-site. Both impoundments and a hazardous waste container storage area have been closed. The facility operates a waste water treatment center for corrosive wastes prior to discharge under the facility's NPDES permit. Hazardous wastes are stored less than 90 days in a well maintained area, prior to off-site disposal.

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5 Letter. Certification of Closure. From: W. F. McGuire, Manager, Environmental Protection Department, Houston Lighting and Power. To: Minor Hibbs, Hazardous and Solid Waste Division, Texas Water Commission. November 6, 1985. TXD009837435.

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7 Solid Waste Compliance Monitoring Inspection Report, Greens Bayou Generating Station. Prepared by the Texas Water Commission. August 1986.

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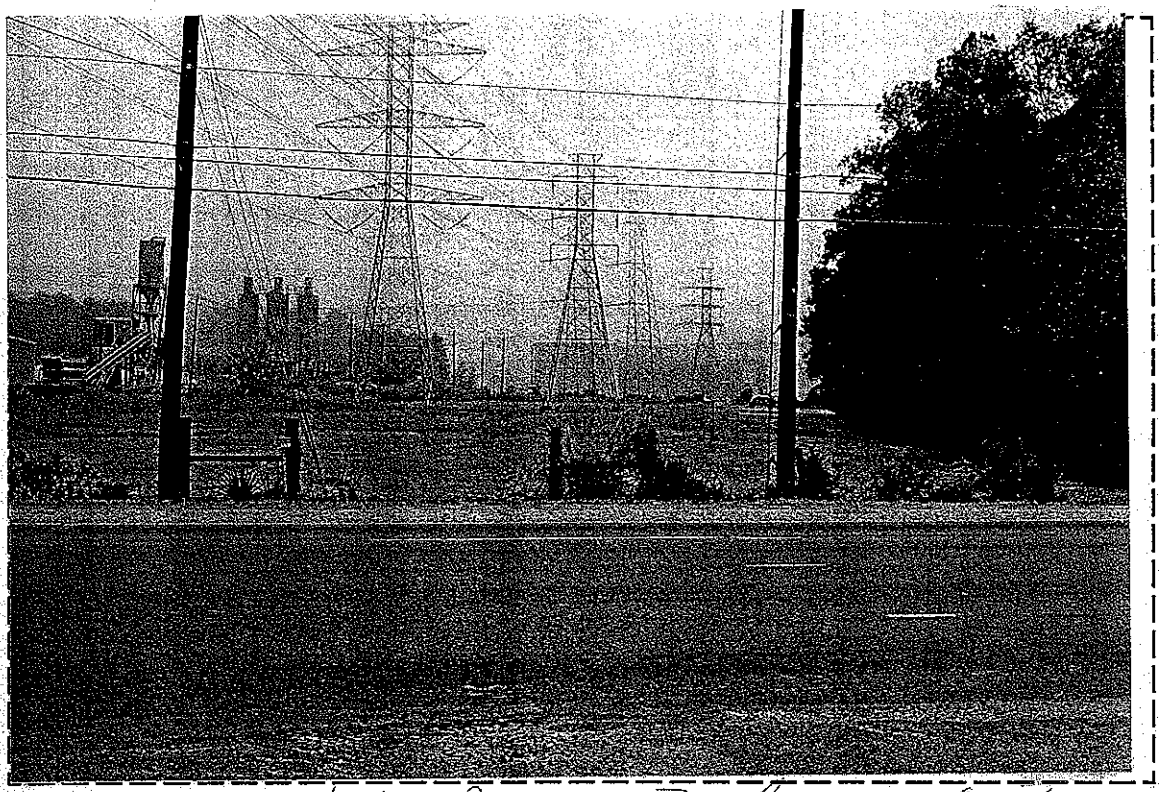
Photo No. 1



Site Name:
HOUSTON LIGHT & POWER COMPANY GREENS BAYOU PLANT

Location:
HOUSTON TEXAS

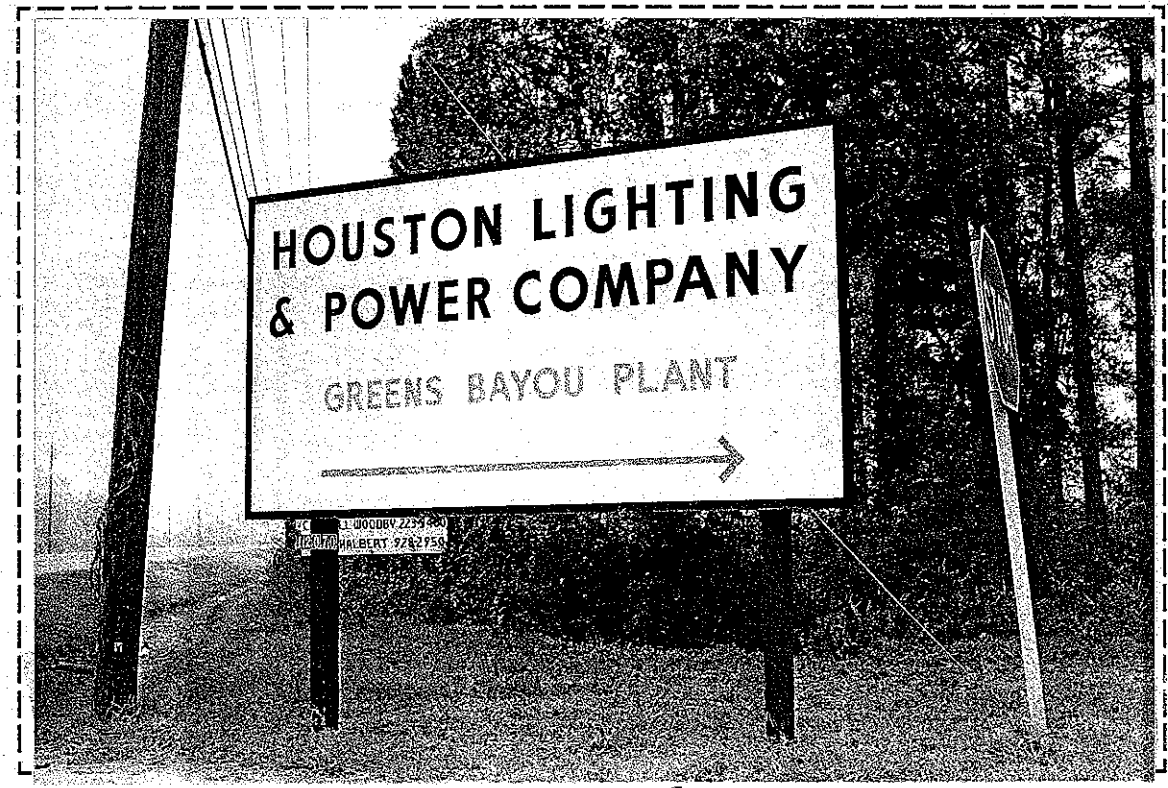
CERCLIS #:
TXD00083735

Photographer/Witness Kelly L Bradley, Brenda Tilson Cook

Date 10/13/89 Time 0911 Direction

Description FACILITY OBSERVED FROM CORNER OF HEATHER ROW AND BEAUMONT HIGHWAY

Photo No. 2

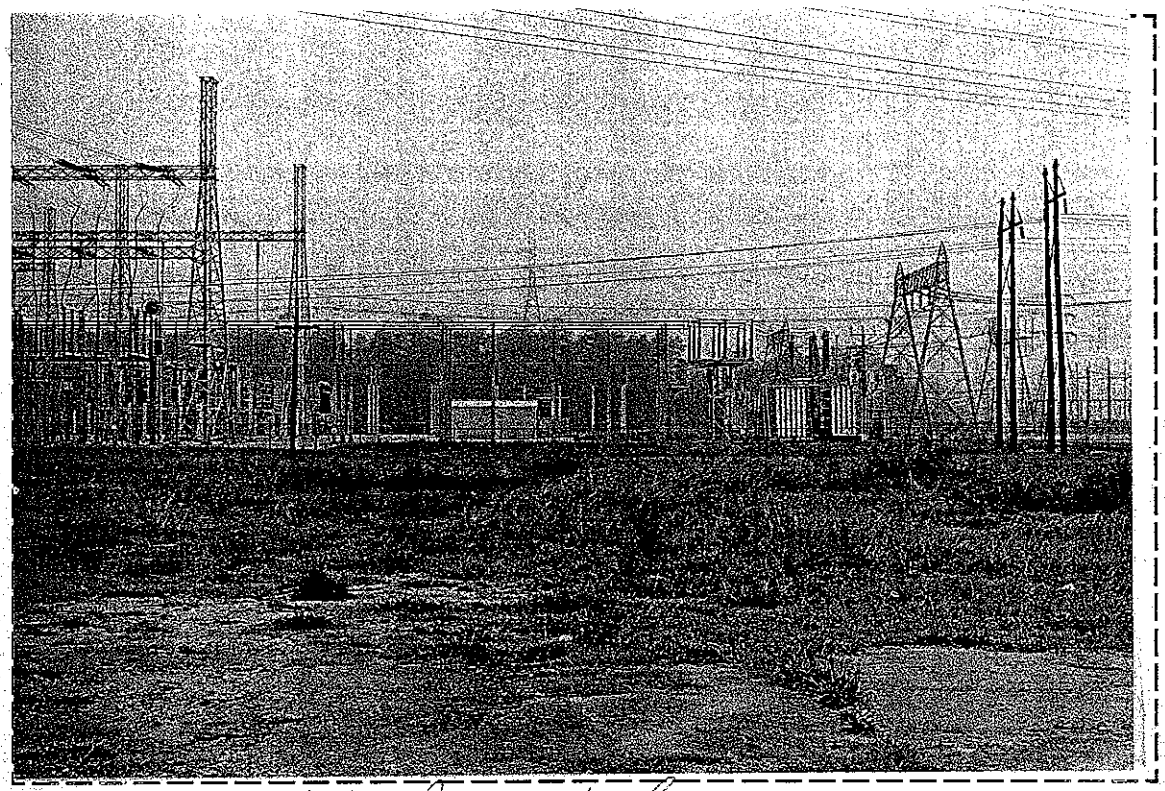


Photographer/Witness Kelly L Bradley, Brenda Tilson Cook

Date 10/13/89 Time 0913 Direction FACING WEST

Description PICTURE OF ENTRANCE SIGN

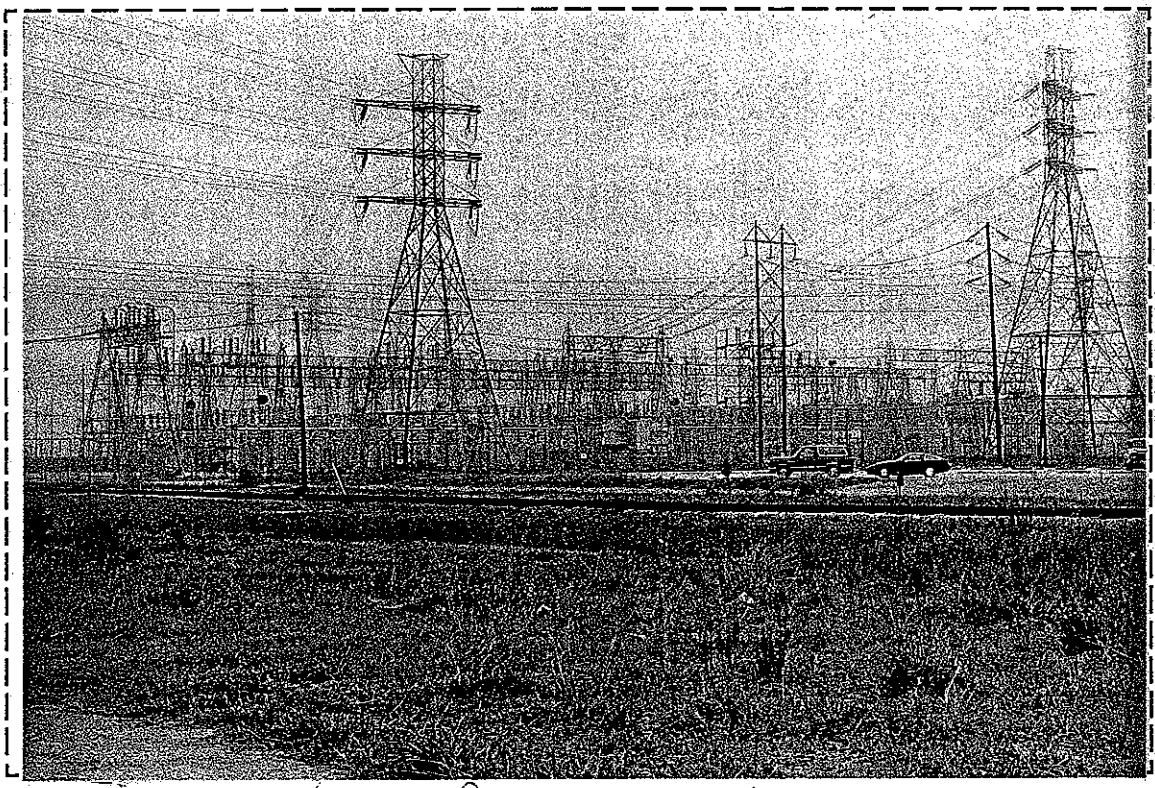
Photo No. 3



Site Name:
HOUSTON LIGHT & POWER COMPANY GREENS BAYOU PLANT
Location:
HOUSTON TEXAS
CERCLIS #:
TXD00083735

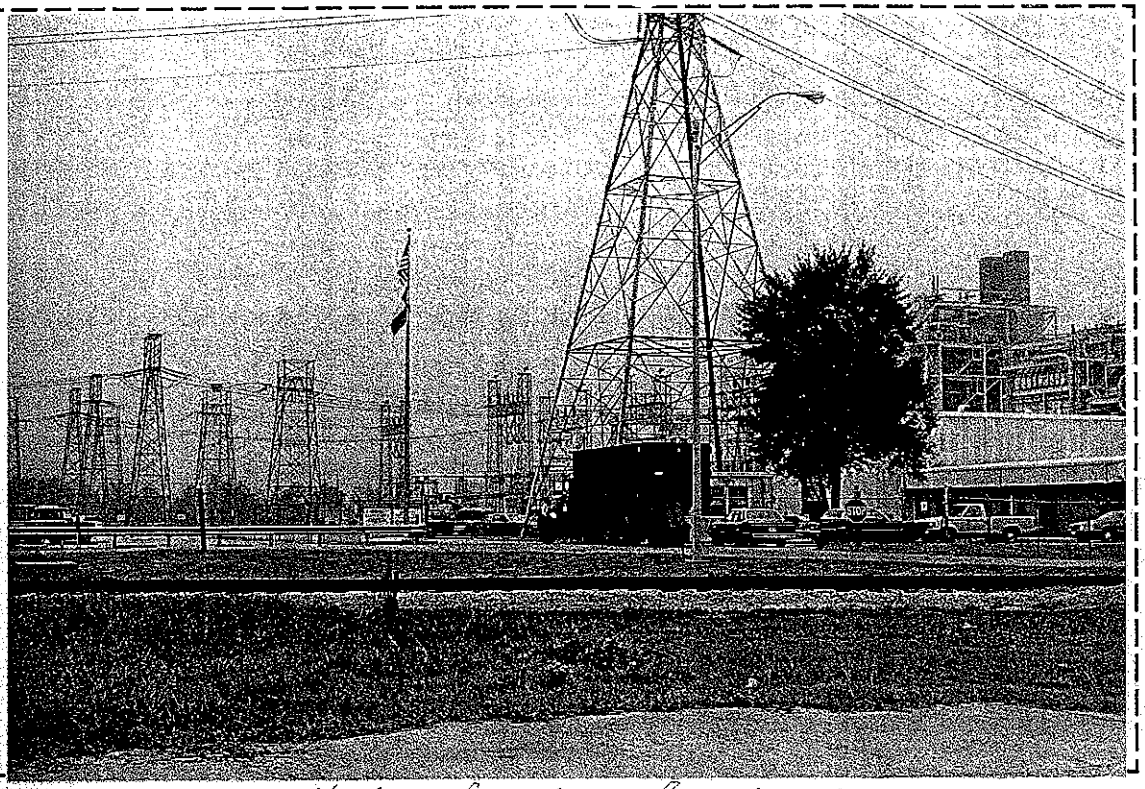
Photographer/Witness Kelly / Bowles / Butler Tyler Cook
Date 10/13/89 Time 0915 Direction
Description PANOROMA OF SITE SOUTHSIDE

Photo No. 4



Photographer/Witness Kelly / Bowles, Butler Tyler Cook
Date 10/13/89 Time 0915 Direction
Description PANOROMA OF SITE SOUTHSIDE

Photo No. 5



Site Name:
HOUSTON LIGHT & POWER COMPANY GREENS BAYOU PLANT

Location:
HOUSTON TEXAS

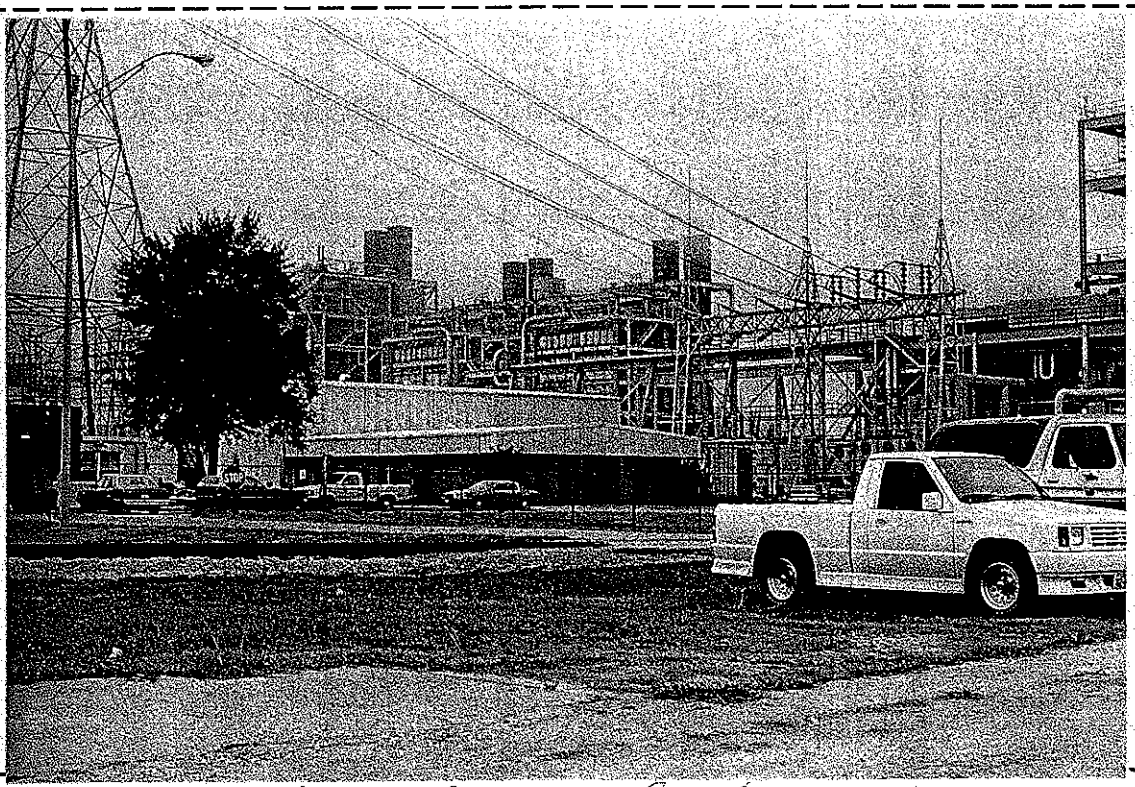
CERCLIS #:
TXD00083735

Photographer/Witness Kelly L Bowles, Barbara Tikalsky

Date 10/13/89 Time 0917 Direction FACING EAST

Description PANORAMA OF FRONT OF FACILITY

Photo No. 6

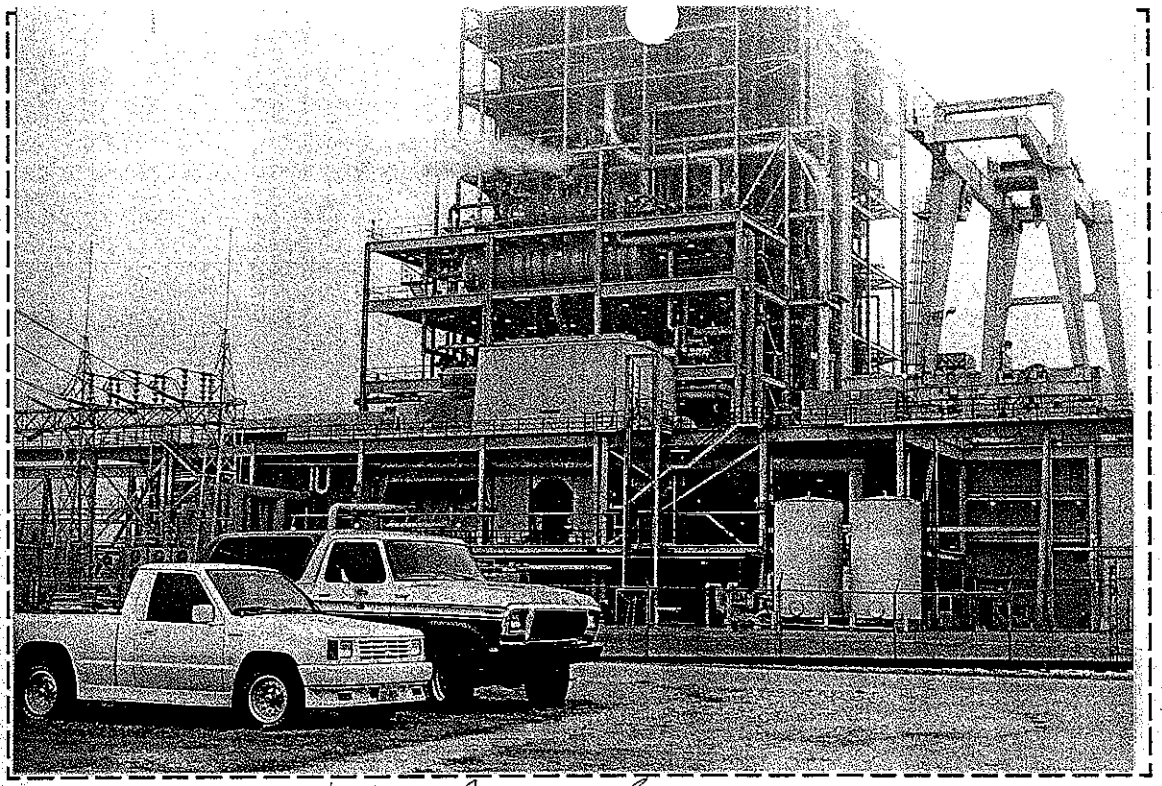


Photographer/Witness Kelly L Bowles, Barbara Tikalsky

Date 10/13/89 Time 0917 Direction FACING EAST

Description PANORAMA OF FRONT OF FACILITY

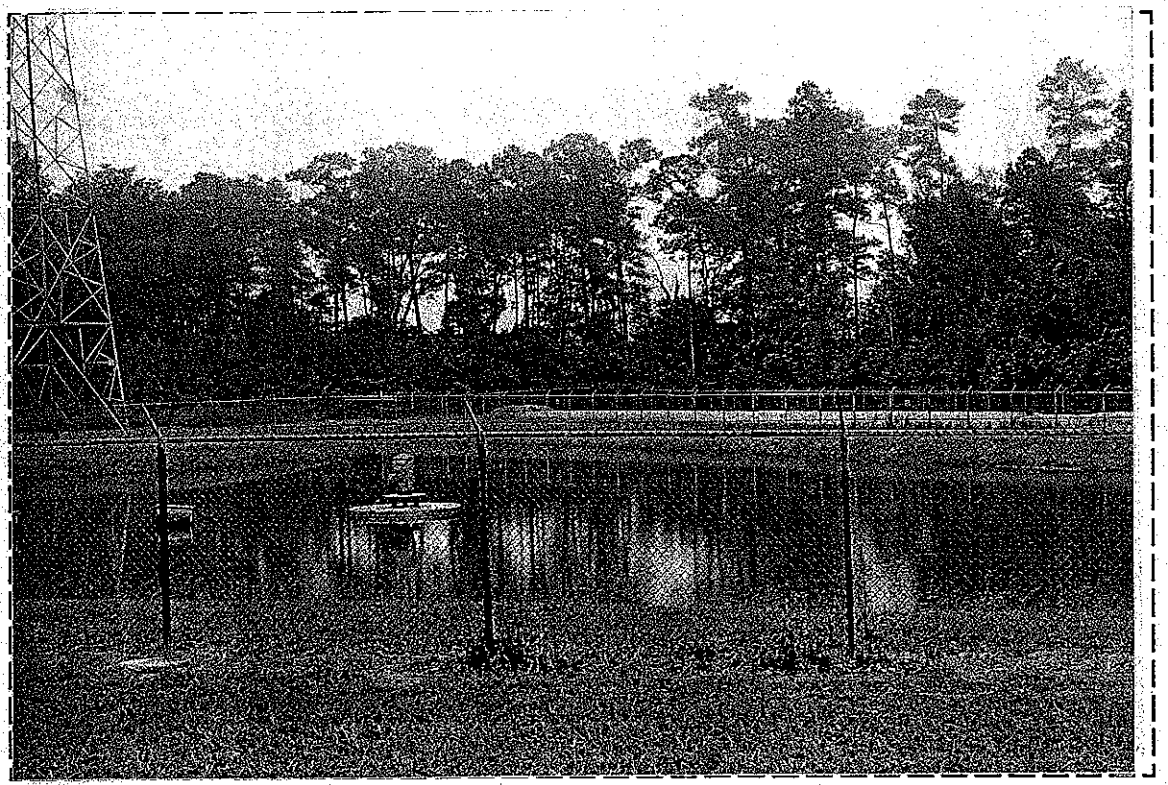
Photo No. 7



Site Name:
HOUSTON LIGHT & POWER COMPANY GREENS BAYOU PLANT
Location:
HOUSTON TEXAS
CERCLIS #:
TXD00083735

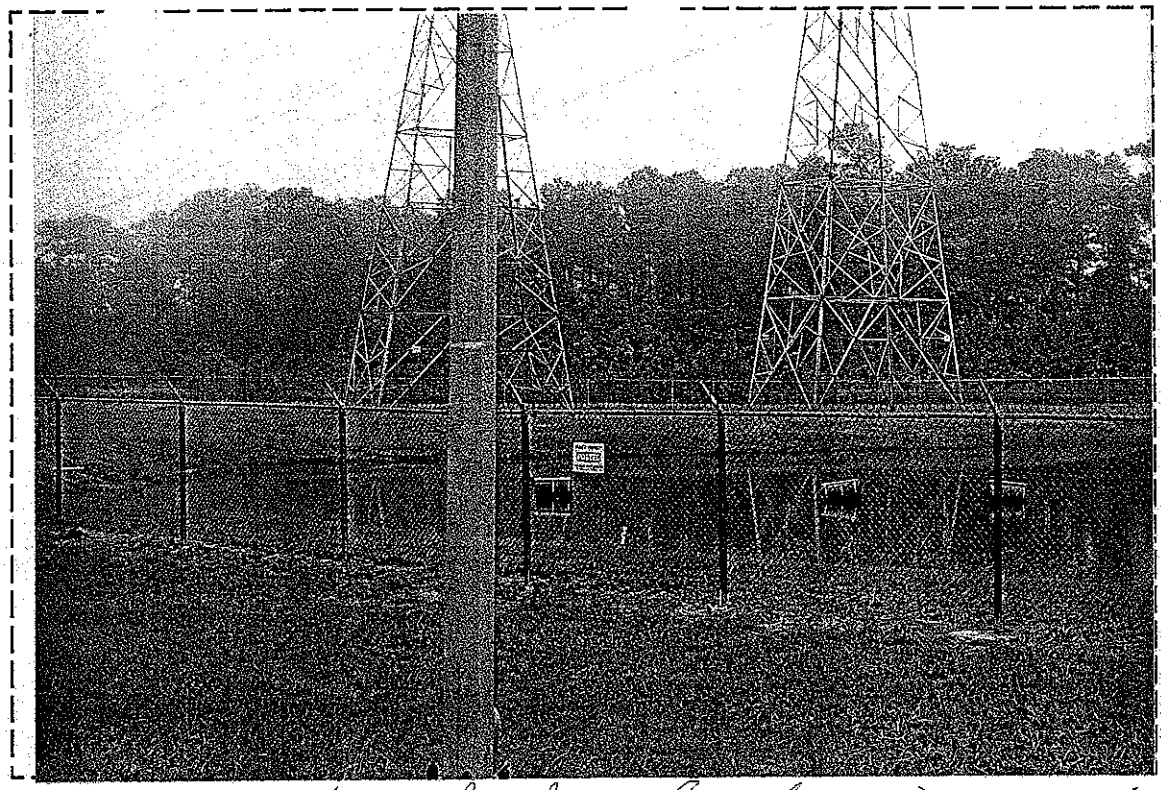
Photographer/Witness Kelly L Bowles, Buck TX Cmte
Date 10/13/89 Time 0917 Direction FACING NORTH
Description PANORMA OF FRONT OF FACILITY

Photo No. 8



Photographer/Witness Kelly L Bowles, Buck TX Cmte
Date 10/13/89 Time 0919 Direction FACING EAST
Description SURFACE IMPOUNDMENT

Photo No. 9



Site Name:
HOUSTON LIGHT & POWER COMPANY GREENS BAYOU PLANT

Location:
HOUSTON TEXAS

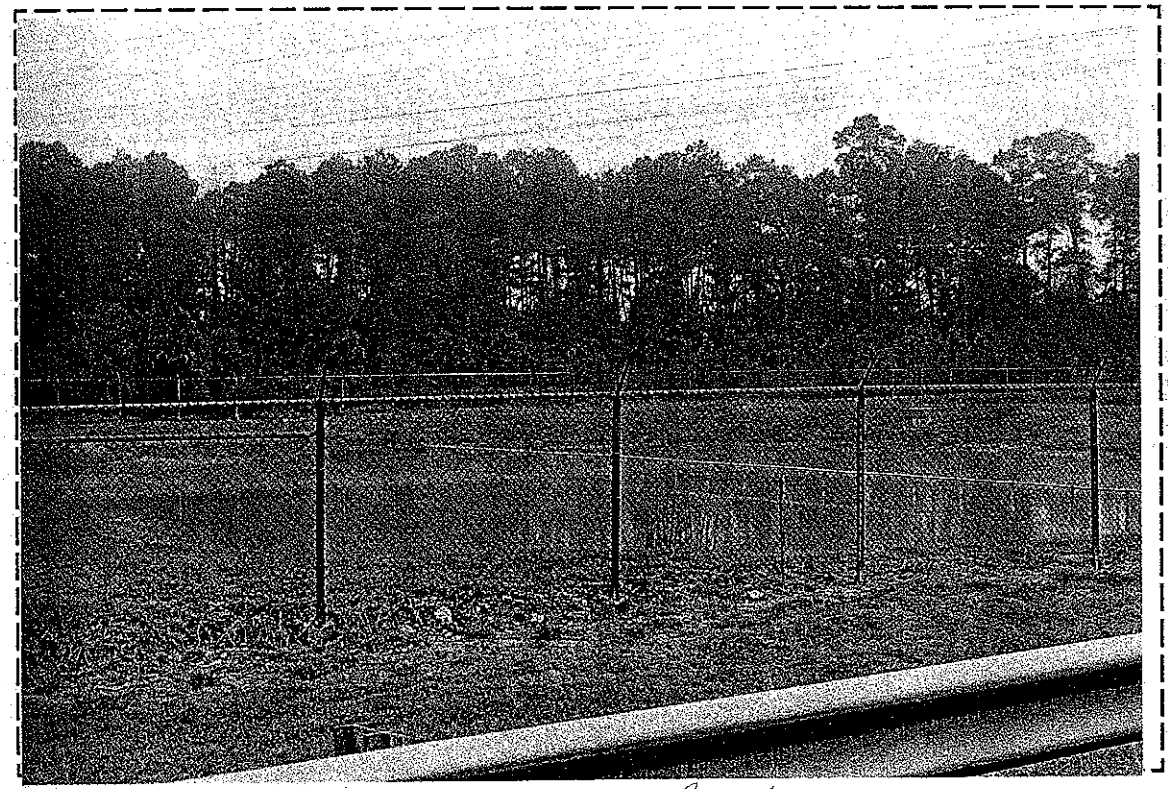
CERCLIS #:
TXD00083735

Photographer/Witness Kelly L Bowles, Barbara Tipton Cook

Date 10/13/89 Time 0919 Direction FACING SOUTHEAST

Description SURFACE IMPOUNDMENT

Photo No. 10



Photographer/Witness Kelly L Bowles, Barbara Tipton Cook

Date 10/13/89 Time 0920 Direction FACING SOUTHEAST

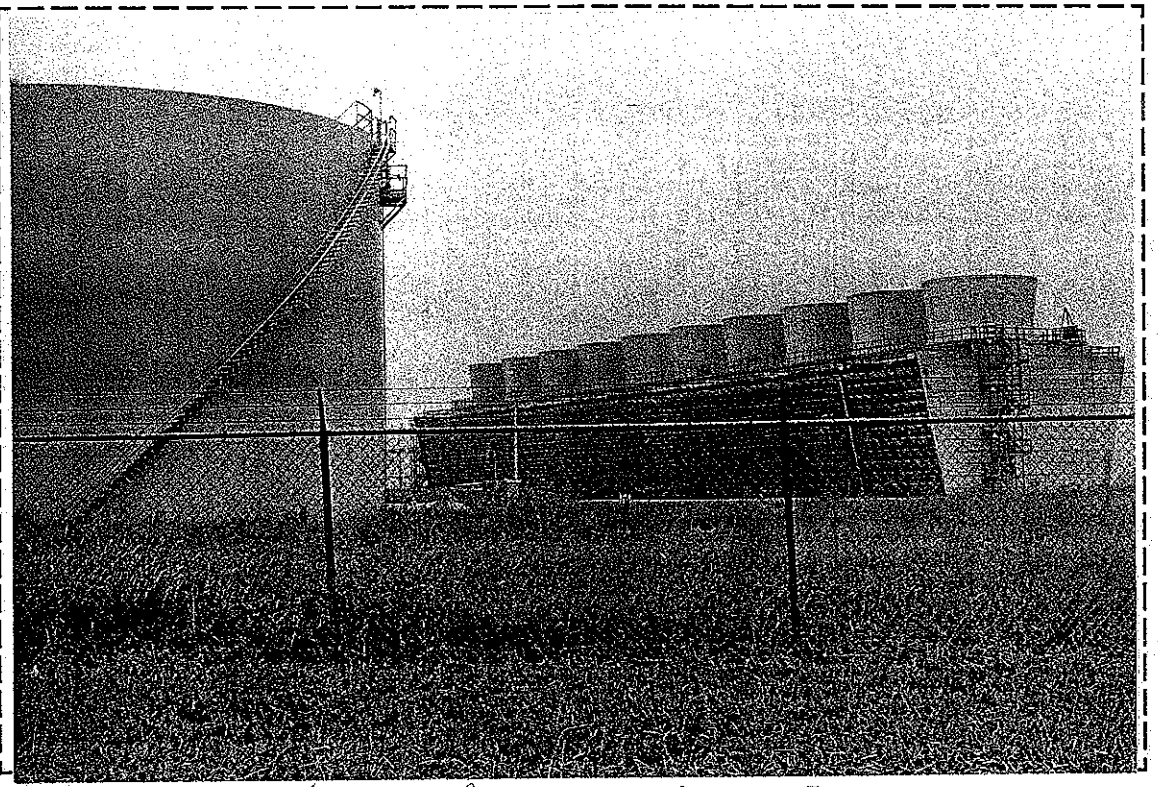
Description HOLDING PONDS

Photo No. 11

Site Name:
HOUSTON LIGHT & POWER COMPANY
GREENS BAYOU PLANT
Location:
HOUSTON TEXAS
CERCLIS #:
TXD00083735

Photographer/Witness Kelly Bowles, Brad Nixon Cook
Date 10/13/89 Time 0920 Direction FACING SOUTH
Description ACID POND

Photo No. 12



Photographer/Witness Kelly Bowles, Brad Nixon Cook
Date 10/13/89 Time 0922 Direction FACING SOUTH
Description BOILER EXHAUSTS

Photo No. 13

Site Name:
HOUSTON LIGHT & POWER COMPANY GREENS BAYOU PLANT

Location:
HOUSTON TEXAS

CERCLIS #:
TXD00083735

Photographer/Witness Kelly L Bowles,

Date 10/13/89 Time 0925 Direction FACING SOUTH

Description SITE FENCE

Photo No. ____

Photographer/Witness ____

Date ____ Time ____ Direction ____

Description ____

Projected

HRS SCORING PACKAGE

SITE NAME: Houston Light and Power — Greens Bayou Generating Station **PREPARER:** Brenda Nixon Cook
LOCATION: Houston, Harris County, Texas

1. GENERAL COMMENTS/OBSERVATIONS

Sources

Sand Drying Beds
Metal Cleaning Inorganic Pond
Demineralizer Regenerant Collection Pond
3 Metal Cleaning Organic Acids Collection Ponds
Hazardous Waste Container Storage Area
Waste Oil and Sludge Collection Facility (Ref. 2, p. 8; Ref. 9, pp. 16, 17)

Hazardous Waste Quantity

The area of the sand drying beds is unknown.

Metal Cleaning Inorganic Pond: 120 x 180 x 10 = 216,000 ft^3/27 = 8,000 yd^3

Demineralizer Regenerant Collection Pond: 142 x 180 x 8 = 204,480 ft^3/27 = 7,573.33 yd^3

Metal Cleaning Organic Acid Collection Ponds

Pond 1: 0.27 acre x 4,840 yd. x 2 yd. = 2,613 yd^3
Pond 2: 0.49 acre x 4,840 yd. x 2 yd. = 4,743.2 yd^3
Pond 3: 0.74 acre x 4,840 yd. x 2 yd. = 7,163.2 yd^3.

A depth of six feet is projected for the metal cleaning organic acids ponds.

Total hazardous waste quantity is the total volume of all impoundments divided by the hazardous waste quantity factor for surface impoundments from Reference Table 2-5 = 8,000 + 7,573 + 2,713 + 4,743.2 + 7,163,2= 30,092 yd^3/2.5 = 12,037.
HRS Value = 10,000.

II. UNRESOLVED ISSUES OR ASSUMPTIONS

Waste streams associated with this facility are either Class II or Class III industrial solid wastes. Hazardous waste surface impoundments, such as metal cleaning inorganic pond and demineralizer regenerant collection pond were closed under an approved TWC closure plan. The waste streams associated with these impoundments were classified hazardous based on corrositivity. The facility operates its own waste water treatment facility to neutralize these waste streams prior to discharge under NPDES Permit TX006386. Prior to closure, the facility conducted a ground water assessment plan to determine the impact of these impoundments on the underlying ground water. Sulfates were used as an indicator for waste stream migration. Sulfate concentrations in two of the monitoring wells were significantly above background. These impoundments were closed and the new waste water treatment facility was installed in their place. The facility remained in compliance until sampling by the Texas Water Commission (TWC) in October 1987 indicated increased sulfate levels in the monitoring wells. There appears to be migration from the impoundment area to the underlying ground water. However, no hazardous wastes have been detected, therefore no preliminary HRS score for this facility will be evaluated. However, since migration has been documented for a non-hazardous substance and hazardous wastes such as sulfuric acid, heavy metals, and spent solvents are known to be on-site, only a projected value will be determined.

III. GROUND WATER PATHWAY

(1) Observed Release

There is no documentation to support an observed release of hazardous substances to the ground water, however, a documented release of sulfates to the alluvial aquifer has occurred. There is no known usage of the alluvial aquifer in the target radius of the facility; therefore, an observed release will not be considered for the facility, but potential to release to the lower aquifer will be evaluated (Ref. 12).

HRS Value = 0 (Ref. 1, Section 3.1.1)

(2a) Containment

There is evidence of hazardous substance migration from the surface impoundment (Ref. 3, p. 2; Ref. 12).
HRS Value = 10 (Ref. 1, Table 3-2).

(2c) Depth to Aquifer

The Chicot and Evangeline are the aquifers of concern. Well 65-15-206 is drawing from the Chicot Aquifer at a depth of 85 feet (Ref. 3, p. 71). The distance from the lowest known point of hazardous substance migration is 20 feet (Ref. 3, p. 35). (85 - 20 = 65 feet)

The depth to aquifer is 65 feet for the projected score.
HRS Value = 3 (Ref. 1, Table 3-5).

(2d) Travel Time

Coefficient of transmissivity for Greens Bayou Water Supply Well #2 at a depth of 1,545 feet was 6×10^{-3} cm/sec. (Ref. 3, p. 25, Appendix A).

Value = 35 (Ref. 1, Table 3-6).

(4) Toxicity/Mobility

Contaminant	Toxicity	Mobility	Matrix Value
Sulfuric Acid	100	1*	100
Barium	10	0.002	0.02
Zinc	10	0.002	0.02

*A mobility of 1 is assigned due to the PreScore of sulfates in the ground water.

Value = 100 (Ref. 1, Table 3-9) (Ref. 1, Table 2-4, Table 3-8, Table 3-9, RHRS Raw Data Chemical Factors; Ref. 9, p. 10; Ref. 8, p. 7).

(7) Nearest Well

The nearest well is the Ralston Acres public well located approximately 1/4 mile from the facility boundary (Ref. 3, p. 69). Value = 20 (Ref. 1, Table 3-11).

(8a) Population (Level I)

There are no known contaminated drinking water wells (Ref. 1, Section 3.3.2.2).

(8b) Population (Level II)

There are no known contaminated drinking water wells (Ref. 1, Section 3.3.2.3).

(8c) Potential Population

There are approximately 64,500 people within the target area. All residents within a four mile radius are supplied by ground water. There are at least 33 public supply wells and 193 domestic wells within the target area, as well as 17 water districts. Assuming an even population distribution, potential population (Ref. 3, p. 19; Ref. 16; Ref.; 24).

Distance Category	Population	Distance Weighted Population Values
0-1/4	1,007.8125	1,633
1/4-1/2	1,007.8125	1,013
1/2-1	2,015.6	523
1-2	11,990.6	2,939
2-3	20,259.45	2,122
3-4	28,218.75	1,306
	64,500.025	9,536

Potential = 9,536 ÷ 10 = 953.6. Value = 953.6 (Ref. 1, Table 3-12).

(9) Resources

There are no other documented uses for ground water other than drinking or industrial use (Ref. 3, p. 19). Value = 0 (Ref. 1, Section 3.3.3).

10) Wellhead Protection Area

There are 33 municipal or public drinking water wells within the target distance (Ref. 3, Appendix A; Ref. 24). Value = 20 (Ref. 1, Section 3.3.4).

IV. SURFACE WATER PATHWAY

(1) Observed Release

There is no evidence to support a documented release of hazardous substances to surface water.

Value = 0 (Ref. 1, Section 4.1.2.1.1).

(2a) Containment

There is evidence of hazardous substance migration from the surface impoundment (Ref. 1, Table 4-2; Ref. 12; Ref. 3, pp. 38-42).

Value = 10 (Ref. 1, Table 4-2)

(2b) Runoff

Soils of the Beaumont Clay series are characteristic at this facility. Soils are predominately clay with some sand (Ref. 3, pp. 5, 6; Ref. 18).

HRS Soil Group D (Ref. 1, Table 4-3).

Drainage Area

The drainage area for the sources at the site is estimated to be the area of the facility 406 acres. A value of 2 is given because the drainage area is between 250 and 1,000 acres (Ref. 2, p. 8).

Value = 2 (Ref. 1, Table 4-4).

Rainfall

The two year 24 hour rainfall is 5 inches for the Greens Bayou area (Ref. 4). Rainfall/Runoff Value = 6 (Ref. 1, Table 4-5).

Runoff Factor Value = 15 (Ref. 1, Table 4-6).

(2c) Distance to Surface Water

The facility is located within 100 feet of Greens Bayou (Ref. 25).

Value = 25 (Ref. 1, Table 4-7)

(3a) Containment (Flood)

There is no certification by a professional engineer stating that containment at any of the sources is adequate to protect against floods.

Value = 10 (Ref. 1, Table 4-8).

(3b) Flood Frequency

None of the sources are located within any flood plain of Greens Bayou or Spring Gulley (Ref. 13)

Value = 0 (Ref. 1, Table 4-9).

(6) Toxicity/Persistence

Containment	Toxicity	Persistence	Matrix Value
Sulfuric Acid	100	0.40000	40
Barium	10	1.0000	10
Zinc	10	1.0000	10

Value = 40 (Ref. 1, Table 4-12) (Ref. 1, Table 2-4, Table 4-10, Table 4-12, RHRS Raw Data Chemical Factors; Ref. 8, p. 7; Ref. 9 p. 10).

(9) Nearest Intake

There are no known drinking water intakes located along the 15 mile stream segment distance limit (Ref. 25).

Value = 0 (Ref. 1, Section 4.1.2.3.1).

(10a) Population Level I Concentrations

There is no observed release of hazardous substances to surface water and there are no known drinking water intakes along the 15 mile stream distance limit (Ref. 25). Therefore, Level I concentrations are not evaluated.

(10b) Population Level II Concentrations

There is no observed release of hazardous substances to the surface water and there are no known drinking water intakes along the 15 mile stream distance limit (Ref. 25). Therefore, Level II concentrations are not evaluated.

(10c) Potential Contamination

There is no observed release of hazardous substances to the surface water and there are no known drinking water intakes along the 15 mile stream distance limit (Ref. 25). Therefore, potential contamination is not evaluated.

Projected

(11) Resources

Buffalo Bayou, San Jacinto River and Burnett Bay are designated by the Texas Surface Water Quality Standards as non-contact recreation (Ref. 26).

Value = 5 (Ref. 1, Section 4.1.2.3.3).

IV. SURFACE WATER PATHWAY (concluded)

(15) Toxicity/Persistence/Bioaccumulation

Contaminant	Toxicity	Persis.	Persis./Tox.	BCF	Matrix Value
Sulfuric Acid	100	0.400	40	0.5	20
Barium	10	1.000	10	0.5	5
Zink	10	1.000	10	500	5×10^3

Value = 5×10^3 (Ref. 1, Table 4-16)
(Ref. 1, Table 2-4, Table 4-10, Table 4-12, Table 4-16, RHRS Raw Data Chemical Factors; Ref. 8, p. 7; Ref. 9, p. 10).

(18) Food Chain Individual

A food chain individual is projected since the San Jacinto River, Houston Ship Channel and Burnett Bay are designated as a high aquatic habitat. The dilution weight factor for the average stream flow of 272 ft^3/sec. for Buffalo Bayou is 0.01 (Ref. 1, Table 4-13, Ref. 15). The Food Chain Individual potential value is 20 multiplied by the dilution weight subject to a minimum value of 10.

.01 x 20 = .2

Therefore a value of 10 is assigned for the food chain individual (Ref. 1, Section 4.1.3.3.1).

(19) Potential HFC Contamination

There are no commercial fisheries located within the target distance limit. However, the San Jacinto River and Burnett Bayou are designated high aquatic life habitats by the State of Texas. A production value of 1,000 to 10,000 lbs. per year is projected. An assigned human food chain population value for 1,000 to 10,000 lbs. is 3 (Ref. 1, Table 4-18; Ref. 25).

$$\text{Potential Human Food Chain Contamination} = 1/10 \sum_{i=1}^{n} Pi\ Di$$

Potential Human Food Chain Contamination = 1/10 · 0.1 x 3 = 0.03

Value = 0.03 (Ref. 1, Section 4.1.3.3.2.1).

Projected

(19b) Level I Concentrations

There is no documented observed release of hazardous substances to the surface water and there are no fisheries within the watershed; therefore, Level I concentrations are not evaluated (Ref. 1, Section 4.1.3.3.2.2; Ref. 25).

(19c) Level II Concentrations

There is no documented observed release of hazardous substances to the surface water and there are no fisheries within the watershed. Therefore, Level II concentrations are not evaluated (Ref. 1, Section 4.1.3.3.2.3; Ref. 25).

(23) Ecosystem Toxicity/Persistence/Bioaccumulation

Contaminants	Ecosystem Toxicity	Persistence	Bioaccumulation	Matrix Value
Sulfuric Acid	0	0.4	0	0
Barium	0	1.000	0	0
Zinc	2	1.000	10	500

Value = 5×10^3 (Ref. 1, Table 4-21).
(Ref. 1, Table 4-10, Table 4-12, Table 4-16, Table 4-19, Table 4-20, Table 4-21, RHRS Raw Data Chemical Factors; Ref. 8, p. 7; Ref. 9, p. 10).

(26a) Sensitive Environments Level I Concentrations

There was no documented observed release to surface water; therefore, there are no sensitive environments subject to Level I concentrations (Ref. 1, Section 4.1.4.3.1.1).

(26b) Sensitive Environments Level II Concentrations

There are no documented observed release to surface water; therefore, there are no sensitive environments subject to Level II concentrations (Ref. 1, Section 4.1.4.3.1.2).

Projected

(26c) Sensitive Environments Potential Contamination

Sensitive Environment	Value	Dilution Weight
San Jacinto State Park	25	0.01
Wetlands (2-3 miles)	75	0.01
	100	

The average stream flow of Buffalo Bayou is 272 cfs. (Ref. 15).

Potential = 1/10 · sensitive environment · dilution weight.
Potential = 1/10 · 100 · 0.01 = 0.1

The sensitive environment potential contamination factor is 0.1 (Ref. 1, Table 1-13, Section 4.1.4.3.1.3; Ref. 15; Ref. 25).

Value = 0.1

Projected

HRS SCORING PACKAGE
GROUND WATER TO SURFACE WATER MIGRATION
COMPONENT SCORESHEET

(1) Observed Release

There is no documentation to support an observed release of hazardous substances to the ground water. However, a documented release of sulfates to the alluvial aquifer has occurred. The alluvial aquifer is at a higher elevation than both Spring Gulley and Greens Bayou. Both Spring Gulley and Greens Bayou are within a one mile radius of the facility, allowing the possibility of the migration of alluvial ground water into the surface water (Ref. 1, Section 4.2.1.1; Ref. 3, p. 35; Ref. 25). A documented release cannot be projected since there is no analytical evidence of increased sulfates in the surface water (Ref. 1, Section 4.2.1.3).

Value = 0 (Ref. 1, Section 4.2.1.3).

(2a) Containment

There is evidence of hazardous substance migration from the surface impoundment (Ref. 3, p. 2; Ref. 12).

Value = 10 (Ref. 1, Table 3-2).

(2b) Net Precipitation

Net precipitation value for Houston, Texas utilizing Figure 3-2 is 3.

Value = 3 (Ref. 1, Figure 3-2).

(2c) Depth to Aquifer

The depth to the alluvial aquifer is 20 feet (Ref. 3, p. 35).

The lowest known point of contamination is the alluvial ground water in MW #3 (Ref. 3, pp. 41-48) (20 - 20 = 0). The depth to the aquifer is 0 feet for the projected value. Value = 5 (Ref. 1, Table 3-5).

(2d) Travel Time

The hydraulic conductivity of the soils from MW #3 is 3×10^{-4} cm/sec. at a depth of 20 feet (Ref. 3, p. 29).

Value = 35 (Ref. 1, Table 3-6).

Projected

(4) Toxicity/Mobility/Persistence

Contaminant	Toxicity	Mobility	Toxicity Mobility	Persis.	Matrix Value
Sulfuric Acid	100	1*	100	0.4	40
Barium	10	0.002	0.02	1.0	0.02
Zinc	10	0.002	0.02	1.0	0.02

*A mobility of 1 is assigned due to the presence of sulfates in the ground water (Ref. 1, Table 3-9; Ref. 1, Table 2-4, Table 3-8, Table 3-9, Table 4-26, RHRS Raw Data Chemical Factors; Ref. 8, p. 7; Ref. 9, p. 10).

Value = 40 (Ref. 1, Table 4-26).

(7) Nearest Intake

There are no known drinking water intakes located along the 15 mile stream distance limit (Ref. 25).

Value 0 (Ref. 1, Section 4.1.2.3.1).

(8a) Population Level I Concentrations

There is no observed release of hazardous substances to the surface water and there are no known drinking water intakes along the 15 mile stream distance limit (Ref. 25). Therefore, Level I concentrations are not evaluated.

(8b) Population Level II Concentrations

There is no observed release of hazardous substances to the surface water and there are no known drinking water intakes along the 15 mile stream distance limit (Ref. 25). Therefore Level II contamination is not evaluated.

(8c) Potential Contamination

There is no observed release of hazardous substances to the surface water and there are no known drinking water intakes along the 15 mile stream distance limit (Ref. 25). Therefore, potential contamination is not evaluated.

(9) Resources

Buffalo Bayou, San Jacinto River and Burnett Bay are designated by the Texas Surface Water Quality Standards for non-contact recreation (Ref. 26).

Value = 5 (Section 4.1.2.3.3)

Projected

(13) Toxicity/Mobility/Persistence/Bioaccumulation

Contaminant	Toxicity	Persistence	Persis./Tox.	BCF	Matrix Value
Sulfuric Acid	100	0.4	40	0.5	20
Barium	10	1.0	10	0.5	5
Zinc	10	1.0	10	500	5×10^3

(Ref. 1, Table 2-4, Table 4-10, Table 4-16, RHRS Raw Data Chemical Factors; Ref. 8, p. 7; Ref. 9, p. 10).

Value = 5×10^3 (Ref. 1, Table 4-16).

(16) Human Food Chain Individual

A food chain individual is projected since the San Jacinto River, Houston Ship Channel and Burnett Bay are designated as a high aquatic habitat. The dilution weight factor for the average stream flow of 272 ft^3/sec. for Buffalo Bayou is 0.01 (Ref. 1, Table 4-13, Ref. 15). The food chain individual potential value is 20 multiplied by the dilution weight subject to a minimum value of 10.

.01 x 20 = 0.2

0.2 < 10, therefore a value of 10 is assigned for the food chain individual (Ref. 1, Section 4.1.3.3.1).

(17a) Potential Human Food Chain Contamination

There are no commercial fisheries located within the target distance limit. However, the San Jacinto River and Burnett Bayou designated high aquatic life habitats by the State of Texas. Therefore a production value of 1,000 to 10,000 lbs per year is projected. An assigned human food chain population value for 1,000 to 10,000 lbs. is 3 (Ref. 1, Table 4-1; Ref. 25).

$$\text{Potential Human Food Chain Contamination} = 1/10 \sum_{i=1}^{n} Pi\ Di$$

Potential Human Food Chain Contamination = 1/10 · 0.1 x 3 = .03

Value = .03 (Ref. 1, Section 4.1.3.3.2.1).

(17b) Level I Concentrations

There is no documented observed release of hazardous substances to the surface water and there are no fisheries within the watershed. Therefore, Level I concentrations are not evaluated (Ref. 1, Section 4.1.3.3.2.2; Ref. 25).

Projected

(17c) Level II Concentrations

There is no documented observed release of hazardous substances to the surface water and there are no fisheries within the water shed. Therefore, Level II concentrations are not evaluated (Ref. 1, Section 4.1.3.3.2.3; Ref. 25).

(21) Ecosystem Toxicity/Mobility/Persistence/Bioaccumulation

Contaminants	Ecosystem Toxicity	Persistence	Bioaccumulation	Matrix Value
Sulfuric Acid	0	0.4	0	0
Barium	0	1.000	0	0
Zinc	2	1.000	10	500

Value = 5×10^3 (Ref. 1, Table 4-21)
(Ref. 1, Table 4-10, Table 4-12, Table 4-16, Table 4-19, Table 4-2, Table 4-21, RHRS Raw Data Chemical Factors; Ref. 8, p. 7; Ref. 9, p. 10.)

(24a) Sensitive Environments Level I Concentrations

There was no documented observed release to surface water. There are no sensitive environments subject to Level I concentrations (Ref. 1, Section 4.1.4.3.1.1).

(24b) Sensitive Environments Level II Concentrations

There are no documented observed release to surface water. There are no sensitive environments subject to Level II concentrations (Ref. 1, Section 4.1.4.3.1.2).

(24c) Potential Contamination

Sensitive Environment	Value	Dilution Weight
San Jacinto State Park	25	0.01
Wetlands (2-3 miles)	75	0.01
	100	

The average stream flow of Buffalo Bayou is 272 cfs (Ref. 15).

Potential = 1/10 · Sensitive Environment · Dilution Weight
Potential = 1/10 · 100 · .01 = 0.1 (Ref. 1, Table 1-13, Section 4.1.4.3.1.3; Ref. 15; Ref. 25).

Value = 0.1

V. SOIL EXPOSURE PATHWAY

(1) Likelihood of Exposure

There is no documented surface soil contamination; therefore, this pathway will not be evaluated.

(2) Toxicity

(3) Hazardous Waste Quantity

(5) Resident Individual

(6c) Resident Population

(7) Workers

(8) Resources

(9) Terrestrial Sensitive Environments

(12) Attract/Access

(13) Area of Contamination

(15) Toxicity

(16) Hazardous Waste Quantity

(18) Nearby Individual

(19) Population Within 1 Mile

VI. AIR PATHWAY

(1) Observed Release

There are no analytical results to suggest a documented release to air. Known on-site wastes are not easily volatilized and the possibility of a particulate release is low since all wastes are in liquid form.

Value = 0 (Ref. 1, Section 6.1.1).

(2) Potential to Release	Gas	Part.
Sulfuric Acid	0	11
Barium	0	11
Zinc	0	11

Value of Gas = 0 (Ref. 1, Table 6-7, RHRS Chemical Factors Table).
Value of particulate = 11 (Ref. 1, Section 6.1.2.2.3).

Source Type

Surface Impoundments	33	22
Tanks	28	14

Containment

Gas

Surface impoundments, tanks, drying beds have no known gas collection treatment system. (Ref. 1, Table 6-3).

Value = 10 (Ref. 8, p. 8).

Particulate

All wastes are in liquid form, and there is no known soil contamination at this facility (Ref. 9, pp. 16, 17).

Value = 0 (Ref. 1, Table 6-9).

Mobility

Contaminant	Gas Mobility	Particulate Mobility
Sulfuric Acid	0	0.0008
Barium	0.0002	0.0008
Zinc	0.0002	0.0008

(Ref. 1, RHRS Chemical Factors).

Projected

(4) Toxicity/Mobility

Contaminant	Toxicity	Mobility	Matrix Value
Sulfuric Acid	100	0.0008	0.08
Barium	10	0.0008	0.008
Zinc	10	0.0008	0.008

Value = 0.08 (Ref. 1, Table 6-12)
(Ref. 1, Table 2-4, Table 6-12, Section 6.2.1.2, RHRS Raw Data Chemical Factors; Ref. 8, p. 7; Ref. 9, p. 10).

(7) Nearest Individual

The nearest individuals would be on-site workers (Ref. 25).

Value = 20 (Ref. 1, Table 6-15).

Projected

(8) Population

The population within a four mile radius of the facility estimated from the 1980 Census for Houston, Texas is 64,500. Assuming an even population distribution and utilizing the following formula, the population in

3-4 mile = $\frac{16\ \pi - 9\ \pi}{16\ \pi}$ (4 mile pop.) = .4375 (64,500) = 28,218

2-3 mile = $\frac{9\ \pi - 4\ \pi}{16\ \pi}$ (4 mile pop.) = .3141 (64,500) = 20,259

1-2 mile = $\frac{4\ \pi - \pi}{16\ \pi}$ (4 mile pop.) = .1859 (64,500) = 11,990.55

1/2 -1 mile = $\frac{\pi - \pi/2}{16\ \pi}$ (4 mile pop.) = .03125 (64,500)= 2,015

1/4-1/2 mile = $\frac{\pi/2 - \pi/4}{16\ \pi}$ (4 mile pop.) = .015625 (64,500) =

1,007.8

0-1/4 mile = $\frac{\pi/4}{}$ (4 mile pop.) = .015625 (64.500) = 1,007.8

Distance Category	Population	Distance Weight Value
0-1/4	1,007.8	408
1/4-1/2	1,007.8	88
1/2-1	2,015	26
1-2	11,990	83
2-3	20,259	38
3-4	28,218	23

Total population = 666 (Ref. 1, Table 6-16, Ref. 16).

(8c) Potential Contamination

The potential contamination is equal to the total population (TP) divided by 10. PC = $\frac{TP}{10}$ = $\frac{666}{10}$ = 66.6.

The potential contamination population factor is 66.6 for the Greens Bayou Station.

Value = 66.6 (Ref. 1, Table 6-16, Section 6.3.2.4, Ref. 16).

(9) Resources

There are no known resources such as commercial agriculture, commercial silviculture, or designated recreation area, within 1/2 mile from any source.

Value = 0 (Ref. 1, Section 6.3.3).

(10) Sensitive Environments

Sheldon State Wildlife Management area is located within four miles of the facility (Ref. 25).

(10a) Actual Contamination

There is no analytical data to support actual contamination to the surrounding sensitive environment (Ref. 1, Section 6.3.4.1).

(10b) Potential Contamination

Potential contamination is equal to the value for sensitive environments multiplied by the distance weight divided by 10. The value for Sheldon State Wildllife Management Area is 25. The distance weight is .0014; therefore, the potential contamination value is equal to $\frac{25(.0014)}{10}$ or .0035.

Value = .0035 (Ref. 1, Table 4-23, Section 6.3.4.2, Table 6-4).

TABLE 6-2
GAS POTENTIAL TO RELEASE EVALUATION

Source	Source Type*	Gas Containment Factor Value** (A)	Gas Source Type Factor Value*** (B)	Gas Migration Potential Factor Value**** (C)	Sum (B+C)	Gas Source Value Ax(B+C)
1.	SI	10	33	0	33	330
2.	Tank	10	28	0	28	280
3.						
4.						
5.						
6.						
7.						
8.						
			Gas Potential to Release Factor Value (Select the Highest Gas Source Value)			330

*Source Type from Table 6-4.
**Gas Containment Factor Value from Section 6.1.2.1.1.
***Gas Source Type Factor Value from Table 6-4.
****Gas Migration Potential Factor Value from Table 6-7.

TABLE 6-8
PARTICULATE POTENTIAL TO RELEASE EVALUATION

Source	Source Type*	Particulate Containment Factor Value**	Particulate Type Factor Value***	Particulate Migration Potential Factor Value****	Sum	Particulate Source Value
		(A)	(B)	(C)	(B+C)	Ax(B+C)
1.	SI	0	22	11	33	0
2.	Tanks	0	14	11	25	0
3.						
4.						
5.						
6.						
7.						
8.						
			Particulate Potential to Release Factor Value (Select the Highest Particulate Source Value)			0

*Source Type from Table 6-4.
**Particulate Containment Factor Value from Section 6.1.2.2.1.
***Particulate Source Type Factor Value from Table 6-4.
****Particulate Migration Potential Factor Value from Section 6.1.2.2.3.

SUMMARY SCORESHEET FOR COMPUTING S_m

PRELIMINARY HRS SCORE
DRAFT

NOT EVALUATED

	S pathway	S^2 pathway
Ground Water Migration Pathway Score (S_{gw})		
Surface Water Migration Pathway Score (S_{sw})		
Soil Exposure Pathway Score (S_{os})		
Air Migration Pathway Score (S_a)		
$S^2_{gw} + S^2_{sw} + S^2_{se} + S^2_a$		
$(S^2_{gw} + S^2_{sw} + S^2_{se} + S^2_a)/4$		
$\sqrt{(S^2_{gw} + S^2_{sw} + S^2_{se} + S^2_a)/4}$		

PROJECTED HRS SCORE
DRAFT

	S pathway	S^2 pathway
Ground Water Migration Pathway Score (S_{gw})	100.00	10,000.00
Surface Water Migration Pathway Score (S_{sw})	2.17	4.71
Soil Exposure Pathway Score (S_{os})	0	0
Air Migration Pathway Score (S_a)	5.55	30,802.5
$S^2_{gw} + S^2_{sw} + S^2_{se} + S^2_a$		10,035.51
$(S^2_{gw} + S^2_{sw} + S^2_{se} + S^2_a)/4$		2,508.88
$\sqrt{(S^2_{gw} + S^2_{sw} + S^2_{se} + S^2_a)/4}$		50.09

TABLE 2-2

SAMPLE SOURCE CHARACTERIZATION WORKSHEET

Source: Demineralizer Regenerant Collection Pond

A. Source dimensions and hazardous waste quantity

Hazardous constituent quantity: _____
Hazardous wastestream quantity: _____
Volume: 7,573.33 yd^3
Area: _____
Area of observed contamination: _____

B. Hazardous substances associated with the source.

Hazardous Substance	Available to Pathway						
	Air		Ground Water	Surface Water		Soil	
	Gas	Part		Overland/ Flood	GW to SW	Resident	Nearby
Sulfuric Acid	✓		✓	✓	✓		
Barium			✓	✓	✓		
Zinc			✓	✓	✓		
Sulfate			✓	✓	✓		

TABLE 2-2

SAMPLE SOURCE CHARACTERIZATION WORKSHEET

Source: Metal Cleaning Inorganic Pond

A. Source dimensions and hazardous waste quantity

Hazardous constituent quantity: _____
Hazardous wastestream quantity: _____
Volume: 8,000 yd^3
Area: _____
Area of observed contamination: _____

B. Hazardous substances associated with the source.

Hazardous Substance	Available to Pathway						
	Air		Ground Water	Surface Water		Soil	
	Gas	Part		Overland/ Flood	GW to SW	Resident	Nearby
Sulfuric Acid	✓		✓	✓	✓		
Barium			✓	✓	✓		
Zinc			✓	✓	✓		
Sulfate			✓	✓	✓		
Hydrocloric Acid	✓						

TABLE 2-2

SAMPLE SOURCE CHARACTERIZATION WORKSHEET

Source: Metal Cleaning Organic Acids Collection Ponds

A Source dimensions and hazardous waste quantity

Hazardous constituent quantity: _____
Hazardous wastestream quantity: _____
Volume: Pond 1 is 2,613 yd^3, Pond 2 is 4,743.2 yd^3, Pond 3 is 7,163.2 yd^3
Area: _____
Area of observed contamination: _____

B. Hazardous substances associated with the source.

Hazardous Substance	Available to Pathway						
	Ground Water	Air		Surface Water			
Soil	Gas	Part		Overland/ Flood	GW to SW	Resident	Nearby
Class II Industrial Solid Waste	✓		✓	✓	✓		

TABLE 2-2

SAMPLE SOURCE CHARACTERIZATION WORKSHEET

Source: Sand Drying Beds

A. Source dimensions and hazardous waste quantity Unknown

Hazardous constituent quantity: _____
Hazardous wastestream quantity: _____
Volume: _____
Area: _____
Area of observed contamination: _____

B. Hazardous substances associated with the source.

Hazardous Substance	Available to Pathway						
	Ground Air		Water		Surface Water		
Soil	Gas	Part	Overland/ Flood	GW to SW	Resident	Nearby
Class II Industrial Solid Waste			✓	✓	✓		

Projected

GROUND WATER MIGRATION PATHWAY SCORESHEET

Factor Categories and Factors

	Likelihood of Release to an Aquifer	Maximum Value	Value Assigned	
1.	Observed Release	550	0	
2.	Potential to Release			
	2a. Containment	10	10	
	2b. Net Precipitation	10	3	
	2c. Depth to Aquifer	5		3
	2d. Travel Time	35	35	
	2e. Potential to Release (Lines 2a x (2b + 2c + 2d)	500	410	
3.	Likelihood of Release (Higher of Lines 1 or 2e)	550		410
	Waste Characteristics			
4.	Toxicity/Mobility	*	100	
5.	Hazardous Waste Quantity	*	10,000	
6.	Waste Characteristics	100		32
	Targets			
7.	Nearest Well	50	20	
8.	Population			
	8a. Level I Concentrations	**	0	
	8b. Level II Concentrations	**	0	
	8c. Potential Contamination	**	0	
	8d. Population (Lines 8a + 8b + 8c)	**		953.6
9.	Resources	5	0	
10.	Wellhead Protection Area	20	20	
11.	Targets (Lines 7 + 8d + 9 + 10)	**		993.6
	Ground Water Migration Score for an Aquifer			
12.	Aquifer Score [(Lines 3 x 6 x 11)/82,500]***	100		158.01
	Ground Water Migration Pathway Score			
13.	Pathway Score (S_{gw}), (Highest value from line 12 for all aquifers evaluated)***	100		100

*Maximum value applies to waste characteristics category.
**Maximum value not applicable.
***Do not round to the nearest integer.

Projected

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET

Factor Categories and Factors	Maximum Value	Value Assigned	
DRINKING WATER THREAT			
Likelihood of Release			
1. Observed Release	550	0	
2. Potential to Release by Overland Flow			
2a. Containment	10		10
2b. Runoff	25	15	
2c. Distance To Surface Water	25	25	
2d. Potential to Release by Overland Flow (Lines 2a x (2b + 2c)	500	400	
3. Potential to Release by Flood			
3a. Containment (Flood)	10	10	
3b. Flood Frequency	50	0	
3c. Potential to Release by Flood (Lines 3a x 3b)	500	0	
4. Potential to Release (Lines 2d + 3c, subject to a maximum of 500)	500	400	
5. Likelihood of Release (Higher of Lines 1 or 4)	550		400
Waste Characteristics			
6. Toxicity/Persistence	*	40	
7. Hazardous Waste Quantity	*	10,000	
8. Waste Characteristics	100		18
Targets			
9. Nearest Intake	50	0	
10. Population			
10a. Level I Concentrations	**	0	
10b. Level II Concentrations	**	0	
10c. Potential Contamination	**	0	
10d. Population (Lines 10a + 10b + 10c)	**	0	
11. Resources	5	5	

Projected

(Continued)

Factor Categories and Factors	Maximum Value	Value Assigned	
DRINKING WATER THREAT (Concluded)			
Targets (Concluded)			
12. Targets (Lines 9 + 10d + 11)	**	5	
Drinking Water Threat Score			
13. Drinking Water Threat Score ([Lines 5 x 8 x 12]/82,500 subject to a maximum of 100)	100		0.44
HUMAN FOOD CHAIN THREAT			
Likelihood of Release			
14. Likelihood of Release (Same Value as Line 5)	550	400	
Waste Characteristics			
15. Toxicity/Persistence/Bioaccumulation	*	500	
16. Hazardous Waste Quantity	*	10,000	
17. Waste Characteristics	1,000		32
Targets			
18. Food Chain Individual	50	10	
19. Population			
19a. Potential Human Food Chain Contamination	**	0.03	
19b. Level I Concentrations	**	0	
19c. Level II Concentrations	**	0	
19d. Population (Lines 19a + 19b + 19c)	**	0.03	
20. Targets (lines 18 + 19d)	**		10.03
Human Food Chain Threat Score			
21. Human Food Chain Threat Score ([Lines 14 x 17 x 20]/82,500, subject to a maximum of 100)	100		1.56

Projected

(Concluded)

Factor Categories and Factors	Maximum Value	Value Assigned	
ENVIRONMENTAL THREAT			
Likelihood of Release			
22. Likelihood of Release (Same Value as Line 5)	550		400
Waste Characteristics			
23. Ecosystem Toxicity/Persistence/ Bioaccumulation	*	5×10^3	
24. Hazardous Waste Quantity	*	10,000	
25. Waste Characteristics	1,000		56
Targets			
26. Sensitive Environments			
26a. Level I Concentrations	**	0	
26b. Level II Concentrations	**	0	
26c. Potential Contamination	**	0.1	
26d. Sensitive Environments (Lines 26a + 26b + 26c)	**	0.1	
27. Targets (Value from Line 26d)	**		0.1
Environmental Threat Score			
28. Environmental Threat Score ([Lines 22 x 25 x 27]/82,500, subject to a maximum of 60)	60		0.027
SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE FOR A WATERSHED			
29. Watershed Score*** (Lines 13 + 21 + 28, subject to a maximum of 100)	100		2.03
SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE			
28. Component Score (S_{of})*** (Highest score from Line 29 for all watersheds evaluated, subject to a maximum of 100)	100		2.03

*Maximum value applies to waste characteristics category.
**Maximum value not applicable.
***Do not round to nearest integer.

Projected

GROUND WATER TO SURFACE WATER MIGRATION COMPONENT SCORESHEET

Factor Categories and Factors	Maximum Value	Value Assigned	
DRINKING WATER THREAT			
Likelihood of Release to Aquifer			
1. Observed Release	550	0	
2. Potential to Release			
2a. Containment	10	10	
2b. Net Precipitation	10	3	
2c. Depth to Aquifer	5	5	
2d. Travel Time	35	35	
2e. Potential to Release (Lines 2a x [2b + 2c + 2d])	500	430	
3. Likelihood of Release (Higher of lines 1 or 2e)	550		430
Waste Characteristics			
4. Toxicity/Mobility/Persistence	*	40	
5. Hazardous Waste Quantity	*	10,000	
6. Waste Characteristics	100		18
Targets			
7. Nearest Intake	50	0	
8. Population			
8a. Level I Concentrations	**	0	
8b. Level II concentrations	**	0	
8c. Potential Contamination	**	0	
8d. Population (Lines 8a + 8b + 8c)		5	
9. Resources	5	5	
10. Targets (Lines 7 + 8d + 9)	**		5

Projected

(Continued)

Factor Categories and Factors	Maximum Value	Value Assigned	
Drinking Water Threat Score (Concluded)			
11. Drinking Water Threat Score ([Lines 3 x 6 x 10]/82,500 subject to a maximum of 100)	100		0.47
HUMAN FOOD CHAIN THREAT			
Likelihood of Release			
12. Likelihood of Release (Same Value as Line 3)	550	430	
Waste Characteristics			
13. Toxicity/Mobility/Persistence Bioaccumulation	*	500	
14. Hazardous Waste Quantity	*	10,000	
15. Waste Characteristics	1,000		32
Targets			
16. Food Chain Individual	50	10	
17. Population			
17a. Potential Human Food Chain Contamination	**	0.03	
17b. Level I Concentrations	**	0	
17c. Level II Concentrations	**	0	
17d. Population (Lines 17a + 17b + 17c)	**	0.03	
18. Targets (Lines 16 + 17d)	**		10.03
Human Food Chain Threat Score			
19. Human Food Chain Threat Score ([Lines 12 x 15 x 18]/82,500, subject to a maximum of 100)	100		1.67

(Concluded)

Factor Categories and Factors	Maximum Value	Projected Value Assigned
ENVIRONMENTAL THREAT		
Likelihood of Release		
20. Likelihood of Release (Same Value as Line 3)	550	430
Waste Characteristics		
21. Ecosystem Toxicity/Mobility/ Persistence/Bioaccumulation	*	5×10^3 / 10,000
22. Hazardous Waste Quantity	*	
23. Waste Characteristics	1,000	56
Targets		
24. Sensitive Environments		
24a. Level I Concentrations	**	0
24b. Level II Concentrations	**	0
24c. Potential Contamination	**	0.1
24d. Sensitive Environments (Lines 24a + 24b + 24c)	**	0.1
25. Targets (Value from Line 24d)	**	0.1
Environmental Threat Score		
26. Environmental Threat Score ([Lines 20 x 23 x 25]/82,500, subject to a maximum of 60)	60	0.029
GROUND WATER TO SURFACE WATER MIGRATION COMPONENT SCORE FOR A WATERSHED		
27. Watershed Score *** (Lines 11 + 19 + 26, subject to a maximum of 100)	100	2.17 / **2.17**
GROUND WATER TO SURFACE WATER MIGRATION COMPONENT SCORE		
26. Component Score (S_{gs}) *** (Highest score from Line 27 for all watersheds evaluated, subject to a maximum of 100)	100	**2.17**

*Maximum value applies to waste characteristics category.
**Maximum value not applicable.
***Do not round to nearest integer.

Projected

SOIL EXPOSURE PATHWAY SCORESHEET

Factor Categories and Factors	Maximum Value	Value Assigned	
RESIDENT POPULATION THREAT	NOT EVALUATED		
Likelihood of Exposure			
1. Likelihood of Exposure	550		____
Waste Characteristics			
2. Toxicity	*	____	
3. Hazardous Waste Quantity	*	____	
4. Waste Characteristics	100		____
Targets			
5. Resident Individual	50	____	
6. Resident Population/Resources			
6a. Level I Concentrations	**	____	
6b. Level II Concentrations	**	____	
6c. Resident Population (Lines 6a + 6b)	**	____	
7. Workers	15	____	
8. Resources	5	____	
9. Terrestrial Sensitive Environments	***	____	
10. Targets (Lines 5 + 6c + 7 + 8 + 9)	**		____
Resident Population Threat Score			
11. Resident Population Threat (Lines 1a x 4 x 10)	**		____
NEARBY POPULATION THREAT			
Likelihood of Exposure			
12. Attractiveness/Assessibility	100	____	
13. Area of Contamination	100	____	
14. Likelihood of Exposure	500		____
Waste Characteristics			
15. Toxicity	*	____	
16. Hazardous Waste Quantity	*	____	
17. Waste Characteristics	100		____

(Concluded)

Factor Categories and Factors	Maximum Value	Value Assigned	Projected
NEARBY POPULATION THREAT (Concluded)			
Targets			
18. Nearby Individual	1	____	
19. Population Within 1 Mile	**	____	
20. Targets (Lines 18 + 19)	**		____
Nearby Population Threat Score			
21. Nearby Population Threat (Lines 14 x 17 x 20)	**		____
SOIL EXPOSURE PATHWAY SCORE			
22. Soil Exposure Pathway Score *** (Ss), (Lines [11 + 21] ÷ 82,500, subject to a maximum of 100)	100		[ ]

*Maximum value applies to waste characteristics category.
**Maximum value not applicable.
***No Specific maximum value applies to the factor. However, the pathway score based solely on terrestrial sensitive environments is limited to a maximum of 60.
****Do not round to the nearest integer.

The Light company Houston Lighting & Power P.O. Box 1700 Houston, Tex

L. B. Horrigan, Jr
D. R. Betterton
D. G. Tees
J. D. Parsons
J. M. Newton
G. B. Painter
T. E. Gish
*A. G. Wortham
(*w/attachment - RCRA File #14)

November 6, 1985

Mr. Minor Hibbs
Hazardous & Solid Waste Div.
Texas Water Commission
Post Office Box 13087
Capitol Station
Austin, Texas 78711

SUBJECT: CERTIFICATION OF CLOSURE (31 TAC, SECTION 335.216)
AFFIDAVIT OF EXCLUSION FROM HAZARDOUS WASTE PERMITTING
Greens Bayou Generating Station, TWC No. 31634

Dear Mr. Hibbs:

Certification is hereby made that the hazardous waste surface impoundment identified as facility number 02 on the Notice of Registration has been closed in accordance with the closure plan submitted by letters dated April 16, 1984, and August 8, 1984, and approved by the TWC on September 17, 1984. Enclosed is a certification of closure for this facility by an independent registered professional engineer.

Certification is also hereby made that the hazardous waste container storage area identified as facility number 06 on the Notice of Registration has been closed in accordance with the closure plan submitted on May 13, 1985, and approved by the TWC on September 23, 1985. Enclosed is a certification of closure for this facility by an independent registered professional engineer.

These closures constitute full facility closure of all hazardous waste units at Greens Bayou. Therefore, a signed and notarized Affidavit of Exclusion from Hazardous Waste Permitting is enclosed for your processing.

Class I hazardous wastes identified on the facility's current solid waste registration are handled as follows:

a. Paint thinner - drum storage onsite for less than 90 days; shipment offsite for disposal.

b. Mercury-contaminated waste - drum storage onsite for less than 90 days; shipment offsite for disposal.

c. Hydrazine - drum storage onsite for less than 90 days; shipment offsite for disposal.

d. Spent solvents - drum storage onsite for less than 90 days followed by shipment offsite for disposal; or, small amounts mixed with waste oil and sold to a recycler; or, incineration in the generating station's high-efficiency boiler.

e. Sandblast grit - container storage onsite for less than 90 days; shipment offsite for disposal.

f. Inorganic metal cleaning waste - when generated, the hazardous portion is routed to a separate compartment in a fiberglass-lined concrete tank prior to treatment and discharge as per NPDES permit requirements. The tank meets the RCRA permit exemption requirements as defined in 40 CFR 264.1.

f. Demineralizer acid and base regenerant wastewater - routed to a fiberglass-lined concrete tank prior to treatment and discharge as per NPDES permit requirements. The tank meets the RCRA permit exemption requirements as defined in 40 CFR 264.1.

If you have any questions regarding this matter, please contact Dr. R. D. Groover at 713/922-2195.

Sincerely,

W. F. McGuire
Manager, Environmental Protection Department

RDG/rmr
Attachment

cc: Texas Water Commission, District 7 (Deer Park, Texas)

AFFIDAVIT OF EXCLUSION FROM HAZARDOUS WASTE PERMITTING REQUIREMENT

Registration No. 31634

Application No. _____
(Dept. Use Only)

Facility Name Greens Bayou Generating Station

County of Harris

L. B. Horrigan, Jr. being duly sworn, deposes and says:

I am Vice President, Fossil Plant Engineering and Construction (Title (Owner or Principal Officer)) of Houston Lighting & Power Co. (Facility Owner)

Post Office Box 1700; Houston, Texas 77001 (and Address)

This affidavit is being executed for the purpose of notifying the Executive Director of the Texas Department of Water Resources that the named facility does not require a hazardous waste permit because:

Check appropriate box(es):

☐ No hazardous waste is stored, processed or disposed on-site

☒ The facility qualifies for the "Accumulation Time" storage exclusion of Texas Administrative Code, Section 335.69

☐ The facility qualifies for the "Small Quantity Generator" exclusion of Texas Administrative Code, Section 335.2(e)

☐ The facility qualifies for the "Elementary Neutralization Unit" exclusion of Texas Administrative Code, Section 335.2(f)

☒ The facility qualifies for the "Wastewater Treatment Unit" exclusion of Texas Administrative Code, Section 335.2(f)

☐ Other (Explain with an attachment and reference TDWR rule)

Signature

Sworn to before me this 6TH day of NOVEMBER, 1985.

Marilynn M. Holen
Notary Public in and for

HARRIS County, TEXAS

My commission expires 4-27-88

HL&P GREENS BAYOU STATION

CERTIFICATION OF CLOSURE

CONTAINER STORAGE AREA

1.0 INTRODUCTION

In May of 1985, a plan was developed for closure of a hazardous waste container storage area at Houston Lighting & Power Company's Greens Bayou Generating Station. The formal plan was presented in accordance with the closure requirements of 31 TAC, Section 335, Sub-Chapter J and 40 CFR 265.112. As directed by the TDWR, public notification was made of the proposed closure and approval was obtained from the Executive Director of the Texas Department of Water Resources (TDWR), now the Texas Water Commission (TWC). Subsequent to the receipt of approval, the closure plan was implemented on November 4, 1985. This report represents verification of completion of those activities described in the closure plan along with certification of closure as required by 31 TAC 335.216 and 40 CFR 265.115.

2.0 CLOSURE PROCEDURES

The implementation of the closure procedures were initiated following telephone notification to the regional office of the TWC as required by Section 5.0 of the closure plan. The following steps were taken to complete the closure procedures:

2.1 Removal of Waste Containers - The hazardous waste containers located in the storage area were removed on November 4 and transferred off-site to Rollins Environmental Services, Inc., Deer Park, Texas. The total number of hazardous waste drums removed was twenty.

2.2 Decontamination of the Storage Area - Detergent was applied to the floor and the floor was scrubbed with nylon brushes in order to solubilize any contamination. Absorbent material was applied to the floor to absorb the detergent and water. This was then picked up and placed in a 55 gallon drum. The area was rinsed three times with water using mops. All water and mop heads were placed into the 55 gallon drum.

All rubber boots worn by the clean-up personnel were washed and all containers used were rinsed thoroughly. The saran coated Tyvek suits worn by the clean-up personnel were placed in the drum along with all other contaminated materials. The drum was closed and labeled for off-site disposal.

2.3 Post-Closure Activities - The storage area will continue to be used for containerized hazardous and non-hazardous waste. An inventory of accumulation dates will be maintained to ensure that hazardous waste remains on-site for less than 90 days, thereby not requiring a hazardous waste permit for the container storage area.

3.0 CONCLUSIONS

Based upon the information in Section 2.0, it is concluded that:

3.1 All procedures and notification requirements contained within the closure plan as approved by the TWC have been implemented as proposed.

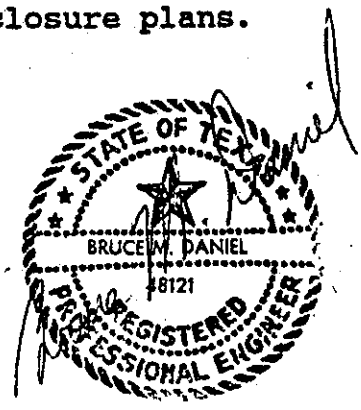
3.2 The facility is no longer considered a hazardous waste storage area for permitting under hazardous waste regulations. It will be subject to regulations governing storage of containerized hazardous waste for less than 90 days per 31 TAC 335.69 and 40 CFR 262.34.

4.0 CERTIFICATION

I am a registered professional engineer in good standing under the Texas Engineering Practice Act, Article 3271a, Vernon's Annotated Texas Civil Statutes. I certify that the verification of closure activities as described by this report represents an accurate summary of the activities performed, and that the facility has been closed in accordance with the specifications contained in the approved closure plans.

Bruce M. Daniel

Bruce M. Daniel, P.E.
Serial No. 48121



TWC Solid Waste Inpection Report
(TAC 335.241-247)
CONTAINER STORAGE AREA CHECKLIST

TWC Reg. No. 31634
Reg. Facility No. 09
Class of Wastes (H,NH,IT)

NOTE: TAC rules 335.241-247 apply to interim status and 90-Day Storage exempt facilities.

		***
1. Are containers in good condition?	YES ✓ NO ___	
2. Are the containers compatible with the wastes being stored?	YES ✓ NO ___	
3. Are containers kept closed and stored in a safe manner?	YES ✓ NO ___	
4. Are containers inspected weekly for leakage and deterioration?	YES ✓ NO ___	
5. Are containers holding ignitable or **reactive** wastes kept at least 15 meters (50 ft.) from the facility's property line?	N/A ___ YES ✓ NO ___	
6. Are containers holding **incompatible** wastes separated by a physical barrier **or** sufficient distance?	N/A ✓ YES ___ NO ___	
7. Does the storage area have containment protection?	YES ___ NO ✓	

8. Describe the Container Storage Area using comments sheet and/or photos:

The containers are stored in an enclosed metal building with a concrete slab. The door is kept locked. The area appeared clean and well maintained. "No smoking" and "Asbestos Dust Hazard" signs were in place. All drums were properly labeled and dated

*** An entry in this column indicates corrective action/response is needed.

10/85

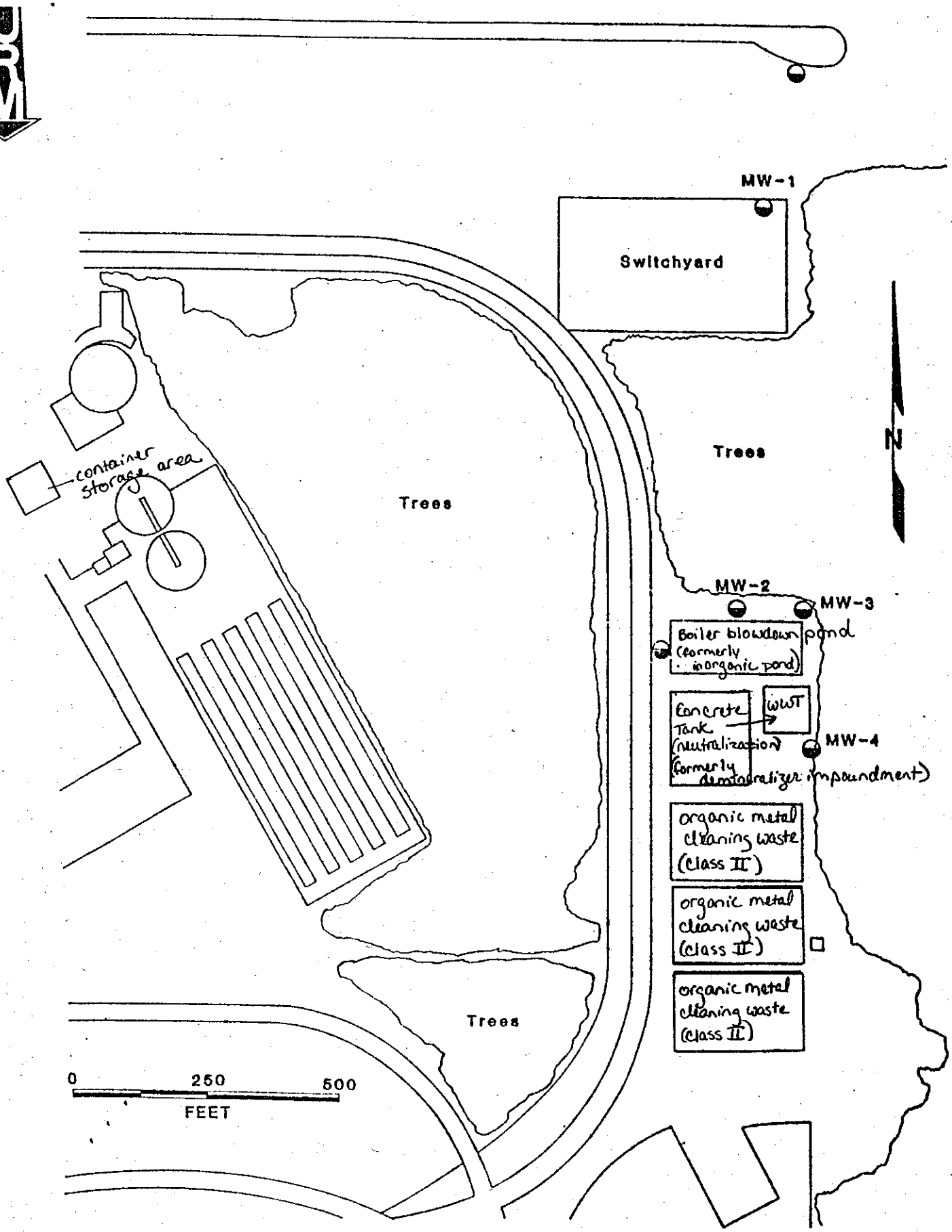


Figure 1. Greens Bayou Generating Station, Site Plan.